MODELING OF ADEQUATE AND LOW-COST DIETS AND THEIR ACCEPTABILITY BY HOUSEHOLDS INKITUI AND TAITA TAVETA COUNTIESIN KENYA

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ABBREVIATIONS

IPC - Integrated Phase classification

KDHS - Kenya Demographic Health Survey

WHO - World Health Organization

FAO - Food and Agriculture Organization

EAR - Estimated Average Requirement

RNI - Recommended Nutrient intake

CoD - Cost of Diet

UK - United Kingdom

ODK - Open Data Kit

BMI - Body Mass Index

FGDs - Focus Group Discussions

DDM - Dietary Diversification and Modification

ASAL - Arid and Semi-Arid Lands

LACON diet - Locally Adapted Cost Optimized Nutritious diet

OPERATIONAL DEFINITIONS

Cost of Diet tool: An analytical tool that utilizes linear programming to evaluate the cost of hypothetical diets that meet the nutritional needs of individuals at the minimum cost on the basis of the price, availability, and nutritional content of locally available foods (Deptford et al., 2017).

Minimally processed fruits and vegetables: These are natural fruits and vegetables altered by processes such as removal of inedible or unwanted parts, drying, crushing, grinding, fractioning, filtering, roasting, boiling, pasteurisation, refrigeration, freezing, placing in containers, vacuum packaging, or non-alcoholic fermentation. None of these processes adds substances such as salt, sugar, oils, or fats to the original food. The main purpose of the processes used is to extend the life of unprocessed foods, allowing their storage for longer use (Monteiro et al., 2016).

Household: Social unit composed of an individual or a group of persons that may be related to each other and often share the same residence, living accommodations, and at least one meal per day. These individuals often have a common budget and housekeeping(Forouhi et al., 2019).

Diet: An amalgamation of drinks and food items consumed by an individual meant to provide their nutritional needs (Forouhi et al., 2019).

Adequate diet: This is a combination of foods that contain all nutrients necessary for good health and physical efficiency and is determined by overall food consumption patterns (Forouhi et al., 2019).

Cost of diet: The amount of money spent on foods (Akhter et al., 2018).

Acceptability of diet: The extent to which a diet may be embraced due to its conformity to the cultural and social norms of the local community (Johnston et al., 2014).

ABSTRACT

Kenya has had a serious challenge of food insecurity despite its enormous agricultural potential. While many innovative solutions have been introduced over the years to solve this problem, it persists. Evidence-basedsolutions that capitalise on the local resources of the country are likely to be more successful and sustainable in tackling the food insecurity and nutritional inadequacy menace. The objective of this study was to model locally adapted nutritious diets for both study areas for non- pregnant, non- lactating women aged between 15-49 years old with moderate activity levels.This studywas conducted in Wundanyi and Mwatate Sub-counties in Taita Taveta County and Mwingi Sub-County in Kitui County. Market surveys (25 traders) andFocus Group Discussions(FGDs) involving 29 women of reproductive with moderate activity levels were carried out. Market surveys were conducted to record locally available foods. FGDs were carried out to determine culturally accepted dietary habits. Utilising the proprietary cost of the diet software, standard diets and their costs were modelled.

The results indicate thatgrains and grain-based products take the lion's share of the dietary budget, about 39%-52% for Kitui County and 50%-58% for Taita Taveta County. Vegetable and vegetable products take up a considerable budget throughout the year in both counties 27% and 21.5% for Kitui and Taita Taveta Counties respectively.In Kitui County, the average daily cost of a Locally Adapted Cost Optimized Nutritious(LACON) diet was USD4.36compared to USD 3.46 in Taita Taveta County. In Taita Taveta County, the locally adapted,cost-optimised nutritious diets include Avocados, small, dried fish, Amaranth leaf (as the main vegetable), refined wheat flour and millet grain. In Kitui County, the locally adapted cost optimised nutritious diets include Eggs, vegetable fat, spinach (as the main vegetable), wheat flour and millet grain. These locally adapted diets are designed to provide key nutrients such as protein, carbohydrates, vitamins such as A, B1, B2, C, B12 and crucial minerals such as iron, calcium, and zinc.

In conclusion, the low intake of fruits and the heavy dependence on plant-based sources of zinc and iron among the study populations is a matter of concern that needs to be addressed by policymakers by creating programs that incentivise the production and consumption of such local food.

1. CHAPTER ONE: INTRODUCTION

1.1 Background Information

Food choices vary across diverse cultures and from generation to generation. There are perceptible variations in food habits during individuals' various generational stages, including the commencement of pubescence, the transition into young adulthood, and eventually, the peak productive, consequently to old age(Ree et al., 2008). The loss of conventional food habits has resulted in the reduced farming of conventional foods and diminished dietary diversity that has culminatedin less-than-optimal health and, ultimately loss of vitality of life(Raschke et al., 2007). Middle and low-income countries are gradually transitioning from minimally processed traditional diets to highly refined food items which have been associated to lifestyle diseases such as diabetes(Grebmer et al., 2014).

In both developing and industrialized countries, the proof of the susceptibility of low income communities to obesity is incontrovertible(Sawaya & Roberts, 2003). Most Sub-Saharan countrieshave to contend with multiple encumbrances of malnutrition, with undernutrition sometimes co-existing with being overweight. These problems are further compounded by the rising diet-related non-communicable diseases(FAO, 2015). Low life expectancy is characteristic of low-income households, while for the high-income households, the reverse is true. People in the low-income cadre may need more resources to eat healthily. Steenhuis and others showed that foods without adequate nutrients tend to be more affordable compared to foods rich in nutrients (Steenhuis et al., 2011).

In recent years, a slight decline in malnutrition levels has been observed in Sub-Saharan Africa, with stunted growth due to the same reduction of36%. This development is a testament to the positive progress, yet more needs to be done. In 2014, the prevalence of malnutrition induced stunted growth in Kenya in children under 59 months was 26 %. In rural areas of Kenya, stunting is a major problem affecting children. Its effects have been observed in older children revealing the reliance on nutrient-deficient diets present during the 1000-day window of opportunity during their formative years (Mbogoh & Sudi, 2017).

Malnutrition during the foundational years of life has been associated with the increased vulnerability to disease and infection resulting in higher likelihood of premature mortality. Moreover, malnutrition takes a toll of the growth potential of affected individuals culminating into higher chances of mortality in during adulthood. The overall health

implication is impaired functional performancecoupled with cognitive effects in their adulthood that have negative economic ramifications for the affected individuals and/or their families (Onifade et al., 2016).Additionally, for women, sufficient nutrition in the early and prepubescent years assures appropriate growth during their adolescence thus providing ample nutritional foundation for establishing a healthy pregnancy and vital skeletal condition after menopause(Dunneram & Jeewon, 2015).The importance of maintaining a proper diet throughout one's life process is essential for the alleviation of the harmful implications of inferior nutrition as shown in Figure 1.

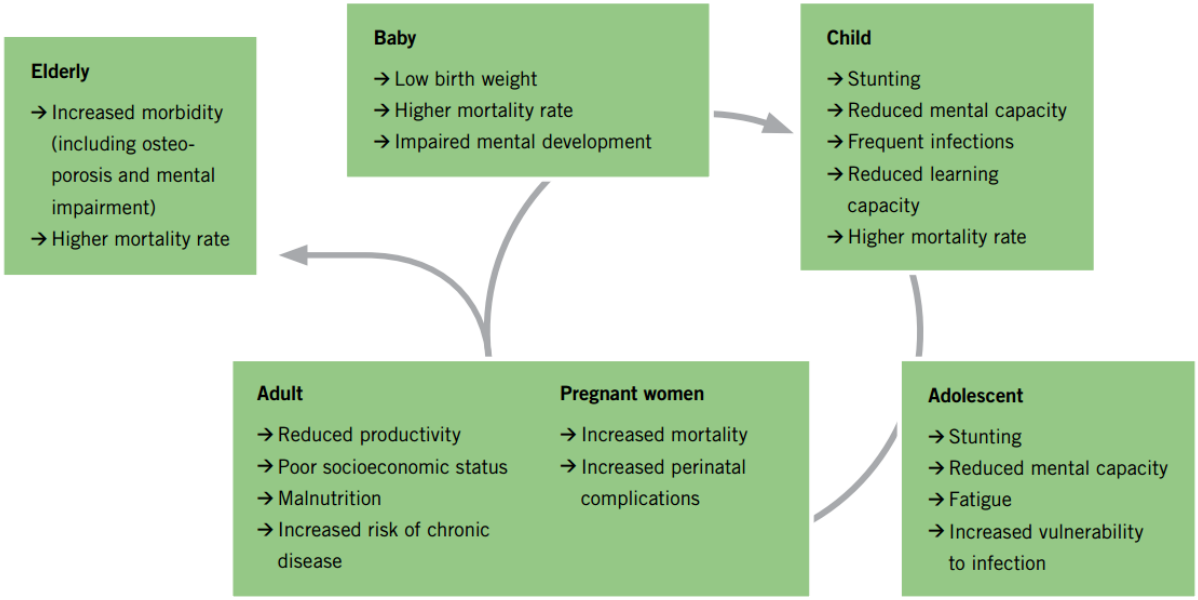

FIGURE 1: CONSEQUENCES OF MICRONUTRIENT DEFICIENCIES THROUGHOUT THE LIFE CYCLE

Source: Adapted from Grebmer et al. (2014)

Concerning proper nutrition, strategies to improve nutritional outcomes need to concentrate on the general dietary patterns as opposed to particular nutritional elements. For effectiveness, nutritional plans should embrace a multilevel approach targeting impactful avenues for such interventions such as worksites, communities and schools thus enhancing their health outcomes(Prieto & Kales, 2016). The modelling of low-cost diets adequate in nutrients is one strategy that can be used to evaluate the cost and affordability of local foods that have sufficient nutritional values and to assess the effect of interventions such as introducing minimally processed fruits and vegetables(Deptford et al., 2017).The obtainability of food either by producing it or buying it is a key determinant of food security

within any given household.Therefore, in instances where the food that has sufficient nutritional value is accessible then the main encumbrance to food security is often economic(Baldi et al., 2013) thereby necessitating mechanisms for the reduction of the cost of diets.

1.2 Statement of the Problem

Based on the reports of the Famine Early Warning Systemsof 2018 that documented the assessment of the impact of changes in precipitation on the availability of food access during the dry season, it is projected that both Taita Taveta and Kitui counties was likely experience below average agricultural yields and hence diminished food accessibility for the residents therein(Fews Net, 2018). This phenomenon is attributed to the erratic and diminished precipitation that had been traditionally relied upon by farmers in this region to grow food that would be useful for nutrition during the dry season. The subpar agricultural yields in these areas have culminated in nutritional deficiency and household food insecurity.In lieu of these circumstances the Kenya Demographic Health Survey (KDHS) report indicated a relatively high levels of stunting in both Taita Taveta and Kitui counties of approximately 45.8% and 23.8 % respectively(Kenya National Bureau of Statistics, 2023).

A viable strategy that can be employed in the mitigation of the nutritional deficiency in the counties under study would be the creation of a suitable diet that meet the nutritional requirements of the households in question. These diets should be available across all seasonsat the lowest possible cost thus ensuring that the target food insecure households not only have access to nutritious food but they can afford it. Studies have shown that diets in both Taita Taveta and Kitui counties are deficient in both vegetables and fruits(Kimiywe& Chege, 2015; Ngetich et al., 2013). The fluctuation in the availability of vegetables and fruits can be attributable to seasonal changes (Joosten et al., 2015). Due to the seasonal availability of vegetables and fruits resulting in nutrient gaps it would be prudent to embrace processing as a mechanism for preservation thereby ensuring the availability of these nutritious food items during the dry/lean seasons(Gallat & Sodoke, 2014).There is limited information on the adequacy and cost of diets in these two counties that could inform policy options.Through the assessment of the traditional foods regularly consumed and the introductionof minimally processed fruits and vegetables, this studysought to model the cost of a nutritious diet fulfilling all the nutrient needs for the women 15-49 years in Kitui and Taita Taveta counties either with or without minimally processed vegetables and fruits.

1.3 Justification of the Study

Year after year, there are media reports of low-income families in sub-Saharan Africa that constantly contend with malnutrition and starvation. This phenomenon which is unrestricted to the African continents arises because of the limited resources such families have to meet their basic needs,including food. There is a manifest necessity for a well-informed public policy that addresses the nutritional needs of such populations, all while putting into perspective the pragmatic resource/wealth constraints that such families face. As such, this study sought to fill in some of the informational gaps necessary for modelling balanced diets that are both consistently available through all seasons and affordable to low-income households domiciled in Taita Taveta and Kitui Counties in Kenya. This study's results will bring about crucial factual insights that may be applied by policymakers, practitioners and researchers when designing low-cost adequate diet interventions as well as tailor-making nutrition advocacy content designed to influence a population's dietary habits towards healthier and more balanced and affordable diets. The residents of Taita Taveta and Kitui Counties stand to benefit from the evidence-based policy prescriptions that would bring about more sustainable interventions for the persistent food insecurity in the region.

1.4 Objectives of the Study

1.4.1 General objectives

The general objective of this study was to model Locally Adapted Cost Optimized Nutritious (LACON) diets from indigenous food sources for non-pregnant non-lactating women aged between 15-49 years with moderate activity levels and children 6-23 months. The choice of these two study groups is informed by the fact that women aged between 15-49 years old perform core productive activities that contribute towards the nutrition of most households in the study area and as such their nutrition and welfare has a disproportionate impact on their households. The choice of children aged between 6-23 years is informed by their increased vulnerability to malnutrition as they transition from relying on breastmilk solely to consumption of other semi-solid and solid foods during this early formative period with significant implications for their future health status and development

1.4.2 Specific objectives:

I. To model locally adapted nutritious diets for both study areas for non-pregnant, non-lactating women aged between 15-49 years with moderate activity levels and children 6-23 months.

II. To model the cost of the locally adapted nutritious diet for both study areas for non-pregnant, non-lactating women aged between 15-49 years with moderate activity levels and children 6-23 months.

1.5 Research Question

I. What constitutes a LACON diet in the study areas for non- pregnant, non-lactating women aged between 15-49 years with moderate activity levels and children 6-23 months in Taita Taveta and Kitui counties?

II. What is the cost of the locally adapted nutritious diet for both study areas for non-pregnant, non-lactating women aged between 15-49 years with moderate activity levels and children 6-23 months?

1.6 Study Assumptions

i. The locally traded foods represent the food produced and consumed locally in the study areas.

ii. A household's diet is influenced by local food availability and affordability.

2 LITERATURE REVIEW

2.1 Economics of Adequate Nutrition

Malnutrition in reproductive age women poses a serious health risk to both the mother and the child. Some of the health risks involved include macronutrient deficiencies which have been known to impede the intellectual development of children as well as cognitive deficiencies stemming from the stunting in the intrauterine growth of infants (Dunneram & Jeewon, 2015).Universally, Iron has been identified as the predominantly deficient nutrient. This is largely the case for pregnant women whose additional need for iron is essential for the proper development of the embryo(Sungkar, 2021).A study on iron deficiency in children by Roganovic&Starinacquotes the following, "Iron is an essential micronutrient in the human body. It plays an important role in many metabolic processes, such as oxygen transport, electron transport, and DNA synthesis. Iron is a component of many cellular proteins and enzymes." Its deficiency should therefore be identified and treated at the onset since if it is allowed to persist,it will have a negative impact on the growth and development of the child (Roganović & Starinac, 2018).

Sub-Saharan Africa and South Asia have the lion share of children with suboptimal health arising from malnourishment. The implication of this phenomenon is approximately two hundred million juveniles living in poverty under the custody of parents or guardians who grew up under similar circumstances and hence perpetuating the cycle of poverty (Grantham-mcgregor et al., 2007). The significance of childhood feeding patterns cannot be understated in these instances because they have a significant role in the spread of chronic lifestyle diseases. As a result of this undeniable fact, most governments have invested significant resources in trying to develop interventions including promotion of diets that are nutrient sufficient. These preventative measures demand a comprehension of the various unique factors that influence household food security thereby requiring a multidisciplinary approach that incorporates different perspectives of research.

Issakaand others established that the frequency of food consumption and quantities eaten in the household directly affect nutrition(Issaka et al., 2015). The availability of food depends on the capability of a household to buy food, which is influenced by the income of a household. A well-off household can afford to consume a variety of foods with adequate nutrients, while the reverse is true for households with lower incomes (Johnston et al., 2014).

Rural Asia and Africa consist of a substantial share of malnourished individuals, with a majority being smallholder farm households looking to farming as their main source of revenue(Nandi et al., 2021). Farming also doubles as an important tool for accessing food among the rural populace. There is a strong association between the effects of climate change and their impact on dietary diversity. In that, moderate weather conditions are imperative for maximum crop yields and in arid and semi-arid areas production of foods such as fruit, vegetable and legume will be adversely affected(Choudhury et al., 2019). In Taita Taveta and Kitui there are many factors that influence the level of agricultural production. The agricultural yields from these regions are affected by such factors such as the level of agricultural knowledge, the availability of a well-nourished workforce and the access to key agricultural inputs such as pesticides, fertilizers and improved seeds (Ismail et al., 2014). Agricultural production in this region is thus susceptible to inadequate rainfall which often culminates in food security consequently resulting in diminished household incomes, food insecurity and malnourished residents (Tsegaye et al., 2018).

As a strategy of mitigating against micronutrient deficiencies and malnutrition, a variety of food-based strategies have been employed. The logic behind this strategy is the diversity of micronutrients provided by a varied diets thus leading to improved health outcomes such as improved anthropometric status of children as well as improved birth weight which are key health indicators. Not only do such interventions foster the consumption of a diverse diets but emphasis is also placed on increasing the quality of food as well as the total food intake. The combination of these three factors are integral for the realization of the improved nutrition status of the population(Honfo et al., 2010). These food-based intervention strategies often involve the incorporation of vegetables and fruits to further diversify local diets thus improving the acquisition of micronutrients intake that is vital for the healthy development of women during their reproductive years (Dunneram & Jeewon, 2015).

One of the key impediments to adequate nutrition for people living in rural regions is the high costs of food (Henning et al., 2018). There is thus a manifest necessity to improve the affordability of food as a means of enhancing the accessibility of food to rural communities thus promoting food security to both reproductive age women and children under five years old (Baharudin et al., 2019;Tarasuk et al., 2007).In as much as studies have shown that diversification of crops leads to improved variety in the diets of the subsistence homesteads, the reverse has been found to be true in some contexts. Food bought from the market has played a major role in providing a diversified diet compared to increasing the variety of foods

for self-sustenance(Nandi et al., 2021).In Western Kenya, participatory community-based farm diversification and nutrition education considerably increased dietary diversity for the children, yet it had little impact on improving nutritional adequacy for the women (Boedecker et al., 2019).

A key implication of improving the quality of food which is essential in improving the nutritional value of such is a corresponding increase in the purchasing cost(Mackenbach et al., 2019). There is thus a need to model an affordable, sustainable and nutritionally adequate diet. This intervention goal can be achieved using an innovative technology called the cost of diet software. This software employs linear programming in addressing multifaceted queries regarding food. The different facets of food that is incorporated into the software includes the variation in nutrient combinations, the different consumption patterns of different communities as well as the variation in the local availability of different foods. In applying these concepts in analysis of diets, this software can be used to model nutritionally adequate and affordable diets that is accepted by the local population (Buttriss et al., 2014).

2.2 Cost of the Diets in the World

COVID-19, the war in Ukraine, Climate change, conflicts, economic upheavals, and inequalities are just some of the drivers that have ensured that food insecurity and malnutrition persist in a heightened state. The existing agricultural policies need to be critically examined to bring about desirable outcomes to move positively towards meeting SDG 2 target by 2030(FAO et al., 2022).

Diets that are sufficient in nutrients evade the poorest of the masses in the world, with Sub-Saharan Africa having the lowest affordability. This is because of the existing inequality in purchasing power. Attempts to improve the nutritional outcomes of its people have led the developing nations to concentrate on offering nutritional education(Bai et al., 2022). This has had far reaching effects in ensuring better health outcomes. However, there is still more that can only be achieved through social protection, cash transfer programs, policies that lower the cost of nutritious foods sold in the market and advocating for increased wages for individuals from households earning low income to improve affordability(Bai et al., 2021).

Bai et al., (2022) records that fruits, vegetables, pulses, nuts and seeds, and plant foods that are packed with nutrients cost significantly higher and consequently make it expensive to achieve the recommended nutrient intake of Calcium and Iron, among other nutrients. It further notes that interventions can be targeted to address how to lessen costs so that these

nutrient-densediets are reasonably priced to sufficiently cater to the nutritional requirements of the populations in the world.

A study carried out in Liberia revealed that the nutrients: fat, vitamin B12, niacin, iron and zinc were the most difficult to meet using the food readily accessible to the community (Byeme et al., 2019). In Pakistan,Vitamin B12, Calcium and Iron could not be adequately met from the diets modelled by the Cost of the Diet software(Beyero, 2018).

An analysis of the feeding habits of residents in Turkana County-which lies within the arid and semi-arid regions of Kenya- brought to light that Iron was a limiting nutrient for diets of children aged 6-11 months, resulting in an increased cost of the diet for the family. Furthermore, the research proved that complimenting the diet with two pouches of micronutrient powders a week could considerably lower the costs of meeting this essential nutrient. In the same study, Kale was found to be a key vegetable in supplying Vitamin A and Vitamin C(Save the Children, 2017).

This result is commensurate with research that concluded that children aged 6-23 years have elevated nutritional needs because of the growth spurt at this stage of development and require foods that are nutrient-dense to complement breast milk and ensure a smooth transition to the foods consumed in the household after 2 years. This will prevent growth faltering caused by insufficient nutrient intake because the foods consumed by the family normally have a lower concentration of nutrients. Having said this, a linear correlation was found between diversity in the child's diet and household income (Choudhury et al., 2019).

Irondeficiency (anaemia) appears to be seven times more in developing nations since diets lack adequate intake of foods rich in heme-iron, compared to the developed nations. New-born babies obtain their iron,about 80 mg/kg, from their mother, but it dwindles during the first six months when they are on breast milk to 60 mg/kg. From here henceforth, the babies should befed daily foods that can amply supplyheme-iron, such as meat andVitamin Cfound in green vegetables, fruits, and juices (Roganović & Starinac, 2018).

Therefore, to achieve desirable iron levels, WHO recommends Iron-Folic Acid supplementation to counter the effects thereof and boost the iron stores for the foetus(Sungkar, 2021). Red meat, poultry and seafood have considerable amounts of heme-iron, which is absorbed 2-3 times faster compared to non-heme-iron which is implicated because of challenges in its bioavailability. A diet that contains Vitamin C enhances the take

up of non-heme-iron from foods in addition to processes such as germination and fermentation which lowers phytate levels thus improving its bioavailability. Vitamin C has little impact on influencing the bioavailability of heme-iron(Sungkar, 2021).

A study done in Bangladesh, revealed that staples, when compared to other groups of food, took the greatest share of the budget (38%). The families had far less expenditure on foods rich in proteins from animal sources, dairy products, and fruits and leafy vegetables. The reason behind this is the increased cost when these foods are included in the diet. Consequently, nutrient-dense foods are not adequately consumed with the overemphasis on starchy staples. A similar picture is seen in South Asia, in that dairy products and foods from animal sources are considered the most expensive of the food groups(Islam et al., 2023).

In Kenya, families residing in the countryside met the nutritional requirements for carbohydrate, protein, and dietary fibre. In contrast, families from urban areas satisfied the nutritional requirements for fruits, vegetables, and fats. An interesting observation is the difference in sensitivity of some foods to adjustments in price. When the cost of animal products and fruits increased the demand reduced. Nevertheless, an upward adjustment of the costs for oils, fats, roots and tubers, salt and non-essential condiments, sugar and confectionery, and beverages had negligible influence on demand(Mohamed et al., 2021).

2.3 Intervention Using Minimally Processed Fruits and Vegetables

The challenge of maternal and child nutrition is closely intertwined with poverty which is the proximate cause of food insecurity in Africa. This phenomenon persists despite the existence of effective programmatic and policy intervention to tackle malnutrition (Morris et al., 2008). The likely reason for this state of affairs is the lack of incorporation of effective design and implementation from places where these policies and programs have worked as well as not adapting the interventions to the local context(Bryce et al., 2008). The said effective programs and policies include nutrition sensitive and nutrition specific interventions meant to combat the underlying causal factors of child nutrition and development(Ruel et al., 2013).

Among residents in rural locations, improved feeding practices has been utilized to enhance the sufficiency of complementary diets. For instance, a study in Malawi determined that the use of indigenous and existing food resources to ameliorate the feeding patterns correlated with the nutritional adequacy of complementary diets (Hotz & Gibson, 2005).

Dietary Diversification and Modification (DDM) strategies involve modification of food production and food selection patterns, in addition to conventional techniques for handling indigenous foods.This is an effective strategy for the enhancement of the accessibility of macronutrient rich foods across all seasons (Gibson, 2014). Consuming a diverse diet is associated with improved nutritional outcomes in juveniles because of the ability to meet the recommended daily intake of nutrients (Arimond & Ruel, 2004). Such diets exploit the bioactive compounds in vegetable and foods which promote better health. Vegetable and fruit rich diet have been proven, through studies, to reduce the lifetime susceptibilityof development of chronic illness (Tarcea et al., 2017) such as coronary heart disease, stroke and cancer (Aly, 2012;Salehi et al., 2010). These same diets been linked to a significant reduction in human thrombosis(Ijiri et al., 2016). Ascorbic acid which is found in vegetables and fruits has been determined to improve infant and foetal development up to six months of age (Jang et al., 2018). The incorporation of vegetables and fruits in diets has been shown to help in the amelioration of the size of waist, hypertension and Body Mass Index over time (Mcnaughton et al., 2007).

As soon as fruits and vegetables are harvested, they continue to grow and live for a short time(Dejene, 2017).This reality necessitates a strategy of either obtaining a continuous supply of vegetables and fruits in which they are in peak production or developing a reliable preservation mechanism (such as freezing or cooling facilities) or the improvement of the use of vegetables and fruits by minimum processing them thereby ensuring the availability of out-of-season foods crucial to nutritionally adequate diets (Gilham et al., 2018). Minimally processing foods involve such activities such as pasteurization, boiling, roasting, crushing, fractioning, grinding, refrigeration, removal of unwanted and inedible parts, placing n containers, non-alcoholic fermentation and vacuum packaging.These activities do not add substances such as fats, oils, sugar and salt. The rationale behind minimally process foods is lengthening their viability as nutrition sources thus helping ensure food security (Monteiro et al., 2016).

2.4 Gaps in the Literature Review

There are numerous studies that explore the challenges of food insecurity and nutritional inadequacy affecting people in various regions of Kenya. However, the scholarly interest has yet to be even, with some regions of Kenya being more heavily researched than others. A cursory review of published articles on this subject matter such as Ferguson et al. (2016); Kariuki et al. (2014); Muinde (2011), Muide(2012); Ngetich et al. (2013) and Pelto & Thuita

(2014) reveals that Kitui county has been more researched than Taita Taveta county. While it is plausible to assume that the findings of studies on nutrition and food insecurity in Kitui county may be generalized to Taita Taveta county given their similarities in climatic conditions as well as their proximity, it is prudent to examine any possible differences that may arise due to the peculiarities of each county. This study inherently tries to compare the two regions through the establishment of locally adapted nutritious diets for non-lactating, non-pregnant reproductive women in these two counties hence filling in part that knowledge gap.

2.4.1 Nutritional values of common local foods in Taita Taveta and Kitui Counties

As established in the previous section, there is likely to be some significant differences between Kitui and Taita Taveta counties that impact nutritional adequacy. Not only are there disparities in the geographical focus of such research but also the specific nutritional aspects that are researched. Perhaps the closest study relating to the focus of this research is Ngetich et al. (2013)which examined the integrated maternal-child health, nutrition, and family planning baseline survey in Taita Taveta. This baseline survey provides crucial insights into the complementary feeding for infants in addition to breastfeeding. This baseline survey indicated that food diversity in this region included the consumption of eggs, meats, poultry and fishes as important sources of iron, proteins and other minerals. Legumes,fruits and other vegetables were also consumed as complementary food but needed to adequately meet the nutritional requirements for vitamin A. Like most studies on this subject matter, the amounts and nutritional values of the local food consumed were not included in the study. Moreover,there were no current studies that focused on the target population for this study.

2.4.2 Dietary diversity of nutrients of common local food in Kitui and Taita Taveta Counties

Nevertheless, another knowledge gap identified in the study is limited information on the dietary diversity of nutrients of common local foods in Kitui and Taita Taveta Counties. According to Klaver & Mwadime (1998) the commonlocal food in the region includes staples such as cassava, cereals and bananas with cereals being a dominant food group in most meals. These findings coincide with those of the County Government of Kitui (2018) that noted maize, millet, sorghum, green grams, sweet potato, cassava, arrow roots, pigeon peas and cowpeas as the dominant food crops in the region whose availability is affected by the seasonality of the rain. However, there is a knowledge gap since(Klaver & Mwadime, 1998)

covered the whole coastal region of Kenya with a focus on Kilifi and Kwale districts with outdated data. Moreover, the dietary diversity of nutrients in Taita Taveta must be added to the literature review, a gap that this study will remedy.

3 MATERIALS AND METHODS

3.1 Study Areas and Populations

3.1.1 Kitui County

According to a report of the census carried out in 2009 Kitui county had an estimated population of 1,012,709 (Mbogoh & Sudi, 2017). This county is categorisedas largely Arid and Semi-Arid Lands (ASAL) based on its physical attributes, low precipitation and associated low agricultural productivity. As such, Kitui county has predictably high levels of poverty given the fact that most of the households rely on agriculture for their livelihood. In 2016, it was estimated that approximately 47.5% of Kitui county residents live in absolute poverty which is relatively higher to the national average of 36.1%.Most Kitui County residents thus face varying levels of food insecurity as they struggle to acquire quality, nutritious and affordable food necessary for the healthy and active growth and development of Kitui residents(Ayala & Meier, 2017). The high poverty levels coupled with food insecurity have the cumulative effect of fostering poor feeding habits of juvenile, dismal hygiene and sanitation practices resulting in poor health outcomes with the inadequate access to quality healthcare services further exacerbating the matter (County Government of Kitui, 2018).The primary economic activity in Kitui county is agriculture and specifically crop farming.Agriculture is integral in the supply of food through commercial and subsistence farming as well as a vital avenue for gainful employment which accounts for 87.3% of the residents in the county. Based on the report by County Government of Kitui (2018),the main food crops grown in this region are cowpea leaves, maize, sorghum, millet, pawpaw, tomatoes, watermelons, sweet potatoes, pigeon peas, sunflower, mangoes, kales, chillies and onions.

Concerning water and sanitation, of the average demand of 50 litres of water per person in urban areas and 25 litres of the same per person in the rural area, they receive only approximately 36 litres in the urban areas and 12 litres in the rural regions of Kitui County. In both regions the access to piped water is below 50% standing at 41.1% in the rural areas and 36% in the urban areas. This statistic translates to 6.8% of households with access to water against the national average of 24%(County Government of Kitui, 2018). The ease of access to water by households in Kitui has a significant influence on the cleanliness and sanitation levels which have a ripple impact on the health outcomes. With regard to sanitation only

56.8% of households have access to improved and unimproved sanitation services and facilities (pit latrines, improved pit latrines, connection to the main sewerage, composting toilet and septic tanks) compared to the national average of 65.3%

Kitui County also has a HIV prevalence of 4.2% which is lower than the national average of 5.6%. However, the prevalence of this infectious is at least twice as high in females than in males with significant implications for household structure and consequently labour force participation and productivity(County Government of Kitui, 2018).Some of the implications of the prevalence of HIV/AIDS include the increase in the number of children living with HIV or at risk of infection, the rise in children headed or single parent headed households, increase in school dropout rates and increase in the number of orphans- often living in extreme poverty.

3.1.2 Taita Taveta County

Located in the coastal region of Kenya, Taita Taveta county is bordered by Kajiado county to the northwest, Kwale and Kilifi County to the east, Tanzania to its south and Tana River to its north. It is approximately 17,084 square kilometres in size with a topography that includes Taita and Saghalla hills (suitable for horticultural production), Plains (which are used for extractive industries such as gemstone mining) and the lower lands in the Taveta region which has a potential for harnessing underground water resources as well as the spring water from the glaciers in Mount Kilimanjaro. Most of the land in Taita-taveta is suited for grazing livestock with only 12% being suitable for crop farming. According to Kariuki et al., (2014) the estimated population of Taita Taveta County in 2017 based on projections was 345,800.Though the distribution is uneven, Taita Taveta receives rainfall twice a year. As is expected the lowlands receive less precipitation compared to the highland regions of the county. The short rains normally occurbetween the last two months of the calendar year while the short rains occur between March and May. The lowlands have suitable conditions for the cultivation of green grams, hybrid fast maturing maize varieties, guava, sorghum, cashewnuts, cowpeas sunflower, millet and green grams. The suitability of this food crops for this region is dictated by their ability to mature fast and also survive the lower precipitation because of the topography. On the other hand, horticultural produce, beans and maize are often grown in the highlands given the higher precipitation that meets this crops' higher moisture/water requirements(Muinde, 2011).

Most of the households in Taita Taveta county for male, femaleand youth- headed households have an average size of five members.Moreover, an estimated 58% of the households in this county are food insecure(Kariuki et al., 2014).This is despite agriculture being the major occupation and source of income for most residents of this county with 90% of the households growing maize, 30.5% growing cowpeas and 46.4 growing beans. While a majority of households in this county depend on maize farming and other associated food crops, other horticultural crops such as tomatoes, bananas and onions are also produced in significant volumes(Kariuki et al., 2014).Moreover, in addition to the production of macadamia nuts, Taita Taveta county produces such industrial crops as cashew nuts, sunflower, coconuts, coffee, cotton and sisal. As such the blended agricultural production not only provided income from the sale of the produce but also the source of domestic food supply for varied households.

Regarding literacy and education levels, approximately 80.4% of all heads of household has attained a minimum of upper primary and secondary school education. At higher levels of educational achievement, the statistics were decidedly lower with only 3.6% of household heads possessing certificate or vocational level education attainment(Kariuki et al., 2014). The female - adult headed households in Taita Taveta county constituted an estimated 20.5% of all households of which approximately a quarter of them do not have any formal education. The education level of household head is significant because it impacts their key decisions that affect the welfare of the family such as the adoption of new agricultural technologies, risk taking appetites and investment decision, all of which influence the household income(Kariuki et al., 2014).Since the adult femalesprovide the largest proportion of labour in crop production activities and as yet have the lowest educational attainment, the region has a low adoption of new farming technologies.

3.2 Study Design

This research employed a longitudinal study design to collect and analyse data collected from the study area during a successive wet and dry season. Data was collected in the month of August of 2019 and follow-up conducted in the month of February the following year.

3.3 Study Population

The target population for this study was non-pregnant, non-lactating reproductive-age women with moderate levels of physical activity and children 6-23 months living in the rural areas of Kitui and Taita Taveta counties.

3.4 Study Setting

The following maps shows the location of the study areas within the larger context of Kenya.

FIGURE 2: MAP SHOWING THE LOCATION OF KITUI AND TAITA TAVETA COUNTIES.

SOURCE: HTTPS://OPENDATA.GO.KE/FACET/COUNTIES

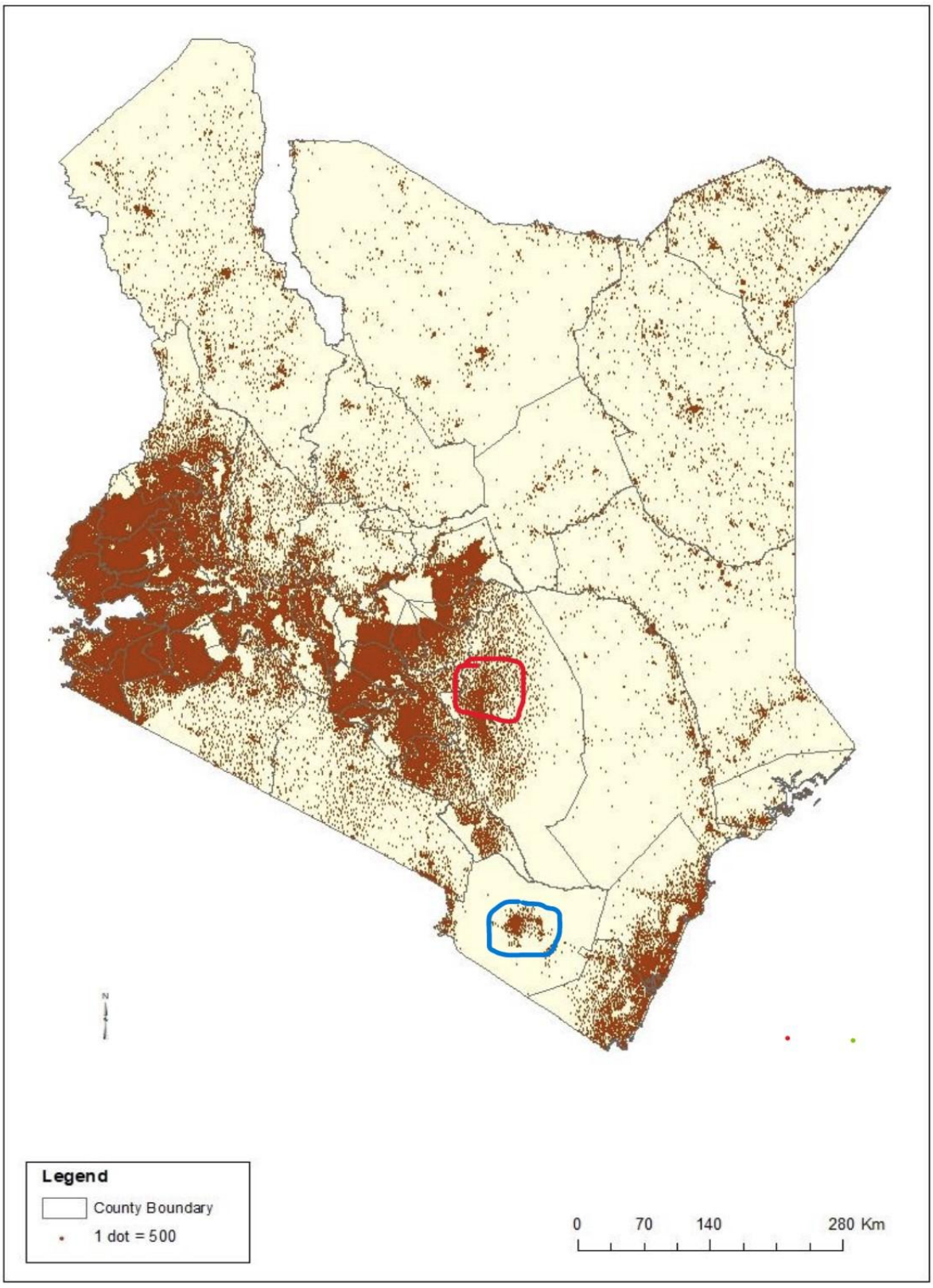

FIGURE 3: MAP SHOWING THE STUDY AREAS - WUNDANYI AND MWATATESUBCOUNTIESIN TAITA TAVETA COUNTY DENOTED BY THE BLUE CIRCLE AND MWINGI SUBCOUNTY IN KITUI COUNTY DENOTED BY THE RED CIRCLE

SOURCE HTTPS://EN.POPULATIONDATA.NET

3.5 Basis of Sampling

In order to obtain sufficient data for the study, random sampling was abandoned in favour of purposive sampling given the lopsided distribution of markets and settlements in the two counties. Purposive sampling facilitated a more effective targeting of sample studyparticipants with a wealth of information on the subject matter at the places that they could be located within the study areas.Similarly, both Kitui and Taita Taveta counties were chosen due to the high production of cowpea leaves and guava fruits despite being arid and semi-arid regions. Both cowpeas leaves and guava fruits are highly nutritious but are underutilized as food sources in these regions due to their seasonality and perishability. This research project thus sought to explore the feasibility of processing and preserving these crops to ensure their availability across all seasons as a means of combating the food insecurity in this region whose residents have an added disadvantage of low educational attainment, heavy dependence on agriculture and high poverty level.

The size of the sample by applying the formula(Naing et al., 2006):

$$n = \frac{Z^2\, P(1-P)}{d^2}$$

Where n= sample size

Z= confidence interval of 95% (standard value of 1.96)

P= proportion of households that are aware of fruits and vegetable processing; since this is unknown, the value 50% will be used.

d= precision value will be 0.06

$$\frac{1.96^2 \times 0.5\,(1-0.5)}{0.06^2} = 266.77 \cong 267$$

Assuming an attrition rate of 10% $\frac{10}{100} \times 267 = 26.7 \cong 27$

Thus, will be $267 + 27 = 294$

The sample size was 294 households per county.

3.6 Data Collection

3.6.1 Data collection tools and procedures

The cost of the diet software was sourced from the Save the Children website. This analytical tool has defined and prescriptive data input requirements that helped guide the type of data that was collected for analysis. As part of the FruVaSe research project, this study benefited from the input of Mr. Jacob Sarfo. This researcher provided crucial insights on how to utilise the Cost of Diet tool based on his experience with the software in similar research projects. Moreover, he also provided guidance on the data collection procedure and methods in a manner that complied with the data input parameters of the data analysis software. The following tools were utilised in data collection.

3.6.2 Market survey

A market survey was conducted in each of the randomly selected 4 villages with 32 traders selling assorted food items. The purpose of using this tool was to collect data on the prices of available foods within the study areas. The cost and weight of each food item being sold was documented. The food merchants were asked to provide the prices of the minimum quantities/ portions of each food sold based on the premise that such portions were affordable to people experiencing poverty who, often because of meagre financial resources, do not buy food in bulk but in small quantities as constrained by their meagre diets. Electronic weighing scales were utilized to measure three weights for each food of the same price except foods with standardised weights on them e.g., tomato paste, fruit juices and biscuits etc. Where practicable in every market the price and quantity (weight) data were collected from three traders, thus obtaining three prices and nine weights (nearest 0.1g) for each food item in each of the markets.

3.6.3 Foods Included in the Model

The model for Kitui County included 79 foods items 78 of which were from the market survey, and breast milk. The model for Taita Taveta had 111 food items, 110 from the data collected from the market and an addition of breastmilk to cater for the infants. The breakdown of their categories is as shown in table 1.

TABLE 1: FOODS INCLUDED IN THE COD SOFTWARE

	KITUI	TAITA
Grains and grain-based products	15	16
Roots and tubers	3	5
Legumes, nuts, and seeds	7	5
Meat and offal	2	5
Fish, seafood, amphibians and invertebrates	1	1
Eggs and egg products	1	1
Milk and milk products	2	4
Vegetables and vegetable products	8	20
Fruits and fruit products	12	20
Fats/oils	3	3
Sugars and confectionary	5	7
Herbs, spices, and condiments	11	15
Beverages	7	7
Supplement and infant foods	1	1
Totals	78	110

3.6.4 Focus Group Discussions

Focus group discussions (FGDs) were used to collect data on dietary patterns. This tool helped collect study data on the type and frequency of the food intake within a week. The information gathered helped inform the number of times a week the software could include or exclude a food item thus establishing the minimum and maximum constraints. It was pivotal that these limits were determined for everyfood type identified in the market. FGDs were utilised to establish these limits and also solicit additional data on food consumption patterns. The FGD queries emanated from comprehensive review of oral submissions from food merchants and responses to the questionnaire. In each of the counties under study two focus group discussions were carried out. Each FGD consisted of ten women who prepared meals for their households.

3.6.5 24-Hour Recall Interview

In addition to the focus group discussions, 29 women (12 women in Kitui County and 17 women in Taita Taveta County)were selected from the pool of the interviewed 294 households to provide insights for a 24-hour recall interview, which was a study being undertaken in this area during the both the lean and plenty seasons. Two (2) women from each of the villages were selected to have an accurate representation of the food consumption patterns in the sub counties under study. The 24- hour recall interview provided a robust basis

for the validation of the data on food consumption frequency and patterns while making sure that the researchers do not miss any foods normally consumed by the study subjects. Moreover, it provided an avenue for asking contextual information about the habitual dietary intake thus providing crucial insights on the acceptability and affordability of various foods within the study population.

3.7 Cost of Diet (CoD) Tool

Developed by Save the Children UK, the Cost of Diet is an innovative tool that employs linear optimization to help model a theoretical diet that is both nutritionally sufficient as well as affordable at a minimum cost by considering such aspect as the availability of food items and their cost within the study area (Baldi et al., 2013).

Using a flow diagram, Figure 2 illustrates how the cost of diet tool incorporates various information in order to model theoretical diets, ultimately culminating in the assessment of the affordability of the model diet to the local community under study (Deptford et al., 2017).

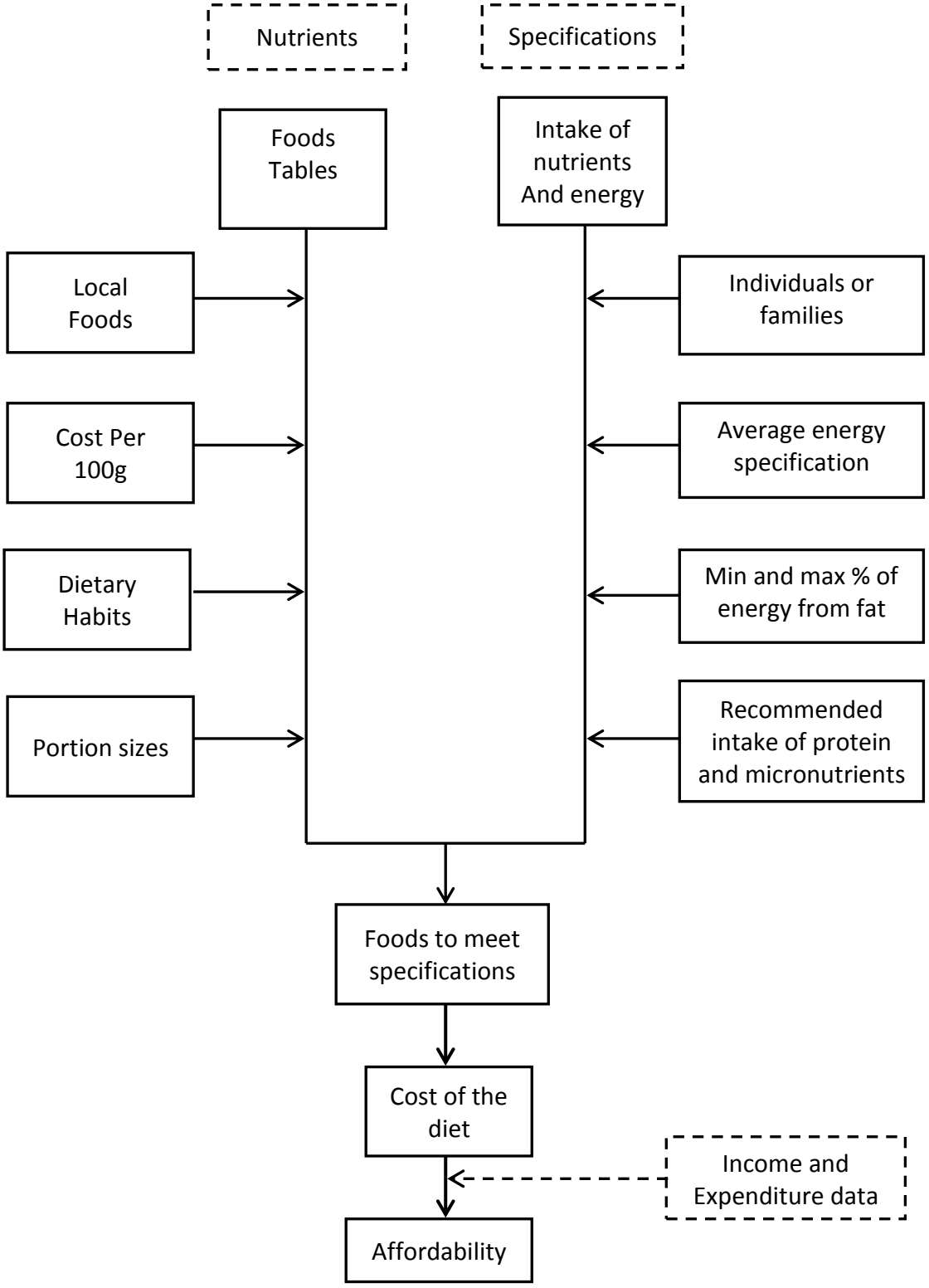

FIGURE 4: A FLOW DIAGRAM OF THE INFORMATION REQUIRED BY THE COST OF THE DIET SOFTWARE TO ESTIMATE THE COST MEETING SPECIFICATIONS FOR ENERGY AND NUTRIENTS

3.7.1 Information that was collected

The information to facilitate the study was collectedi) through a market survey and ii) through focus group discussions. Through the market survey,a list of indigenous food, their costs per 100 grams, and their availability was determined for everysubcounty.Also, Focus Group Discussionswere used to elicit information of the dietary patterns from women within the communities being studied(Deptford et al., 2017).

3.7.2 Information embedded within the software

The World Health Organization and the Food and Agriculture Organization form the basis for the specification of data found within the Cost of Diet tool. These specifications which consists of the estimated required daily intake of the 13 micronutrients, protein and energy for 237 individuals according to their activity level, sex and agewere based on the recommendation of both the WHO and FAO(Deptford et al., 2017).The group of 237 individualswas composed of children, girls and boys classified into four distinct age groups that ranged between 12 to 23 months. The boys, girls and children that were aged between two and eighteen years were classified in one -year intervals. The men within the group were divided into three age groups beginning from 18 years old and weighing between 50-90kg in 5kg subdivisions. Each subdivision has 3 levels of physical activity. For the women, additional information about the nutrient and energy requirements during the three trimesters of pregnancy or lactation was also incorporated within the analytical tool (Deptford et al., 2017).

The approximate energy intake requirements for each individual are documented as Estimated Average Requirement(EAR). In cases where the specification is met, the implication is that there is a 50% chance that the energy requirement for the individual is met but has yet to be surpassed (Deptford et al., 2017). The one in two probability allows for the users to be flexible in analysing the impact of the cost of diet on improving or minimizing the likelihood that the energy needs of the individuals are met while considering the level of activity of the individual or their health status which tend to impact the energy requirements of individuals.

If the individuals' protein specification is achieved, there is a 95% likelihood that the protein requirements of any given individual is achieved. The specifications for fat needs for each

person is set between 20-30% of their mean energy consumption for adults.The needs for each individual for each of the 13 vitamins and minerals are stated as the recommended Nutrient Intake (RNI) (Deptford et al., 2017).

The Cost of Diet tool leverages linear programming to minimize the cost of 4 hypothetical diets while still meeting the mean daily average requirement per person. The four hypothetical diets are based on World Health Organization's recommendations for intake needs for individuals. These four hypothetical diets are a food habits nutritious dietalso referred to as aLocally Adapted Cost Optimized Nutritious diet(LACON) diet, a nutritious diet, a macronutrient diet, and an energy only diet.

By definition, a LACON diet is one that contains the recommended intakes of energy, protein, fat and the thirteen micronutrients but is limited in amount by the typical dietary habits of households in the assessment area. This diet is called a "food habits nutritious diet" in the CoD Software. It is the same as the "nutritious diet", except that it is constrained by environmental and household circumstances like availability and affordability. The constraints that will need to be satisfied are the amount of energy as specified, the proportion of energy from fat as specified, the amounts of proteins and 13 micronutrients, the portion sizes and the weight of food and the frequency of consuming each food group. The software determined whether all the constraints mentioned above are met or not(Deptford et al., 2017).

3.7.3 Information that was added to That Embedded in the Software

Food composition tables were sourced from nine different countries. New foods were added to the cost of diet program, including the relevant information from other food composition tablesso as to have a comprehensive coverage of the food landscape (both locally produced/ indigenous and imported) within the study area. For each food, Save the Childrenhad developed food serving quantities whose values can be adjusted as relevant to the unique circumstances of Taita Taveta and Kitui Counties (Deptford et al., 2017). This information was essential in the additional food groups that were not embedded within the software, thus making the data collection and analysis as locally relevant as possible.

3.8 Exclusion and inclusion criteria

The exclusion criteria for this study included characteristics or factors that made the selected participant ineligible for the study. Study subjects who did not reside in the study areawere excluded from the study because they were likely to erroneously impact the outcome of the study. Other exclusion criteria utilized include women and children who were outside the age

limits of the study andmales (other than those serving in the capacity of store owners and merchants). The inclusion criteria for this study included women 15-49 years with moderate levels of physical activity and children 6-23 months living in the rural areas of Kitui and Taita Taveta counties.

3.9 Ethical and Human Rights Consideration

Ethical clearance was sought from both Taita Taveta and Kitui County offices. Before administering a questionnaire, an information sheet was read in Swahili and clearly explained to the respondents (in the local language if necessary), who then signed the consent form, thus approving their participation in the study.

3.10 Data Management and Analysis

3.10.1 Data Entry

Data from the Market survey and Focus Group discussions were entered into the cost of diet software. The Kenya food composition Table 2018 was used to enter data of some of the foods in addition to the food tables contained therein(Mwai et al., 2018). Where food was not traced in any of the tables inherent in the software, e.g., bitter lettuce, a food from a similar family, i.e., lettuce was chosen from the tables to account for it.

3.10.2 Composition of a Family

The data in this study represents a family of 7 members as follows:

- Child (either sex) 6-8 months
- Child (either sex) 9-11 months
- Child (either sex) 12-23 months
- Female 15-16 years
- Female 17-18 years
- Woman, 18-29 years, 60 kg, moderately active
- Woman, 30-59 years, 60 kg, moderately active (The software caps the age to 59 years rather than 49 years).

The composition was chosen arbitrarily since Household Economic Approach had not been conducted in the study areas. The 2019 Kenya population and housing census revealed that the average household size in Kenya was 3.9 members, which translates to 4 people(KNBS, 2019). The number of 7 individuals includes three more people to ensure that the research achieves its purpose comprehensively.

3.10.3 Types of Diets generated by Cost of diet tool

The four diets generated by the cost of diet tool were a macronutrient diet which incorporates fat, protein and energy, a nutritious dietthat is a macronutrient diet with the additional 13 micronutrients, a LACON diet herein referred to as a food habits nutritious diet (that is a nutritious diet but deficient in the quantity by the usual dietary patterns of households in the study area)and an energy-only diet(Deptford et al., 2017).

Analysis was done for the four diets that the software generates based on calculations using the data input from the market survey and dietary habits interview without altering the underpinning data. The minimum and maximum limits of the data were altered according to the findings of the FGD, which was essential in establishingthe food habits diet.

Having modelledLocally Adapted Cost-Optimized Nutritious (LACON) diets for the study areas, the researcher then sought to determine, using the CoD tool, the costs of those diets. Here, it is worth pointing out that, using the field data entered, the CoD tool generates four standard diets for any selected individual or group of individuals by day, week, season, and year. Besides the food habits nutritious diet, the other three standard diets are energy-only diet, macronutrients diet, and nutritious diet. The four diets are incremental: by adding prescribed nutrient requirements and defining the frequency and amount of each food, a combination of foods that increasingly resembles a balanced diet is created, so the cost usually rises. For instance, the energy-only diet is the least expensive as the tool needs only to meet the selected individual's specified average energy intake. The food habits nutritious diet is usually the most expensive because it meets all nutrient specifications without going beyond any upper limit; meanwhile, constraints are imposed on the amounts and frequencies of foods that can be added to create a combination of foods that closely reflects the foods typically consumed bywomenaged 15-49 years with moderate levels of physical activity and children 6-23 months living in the rural areas of Kitui and Taita Taveta counties.

4 RESULTS

The Cost of the Diet tool output showed the average costs which included for daily, weekly and yearly, the nutrient specifications met, and the type and number of foods and food groups selected for individuals and the whole family.

4.1.1 Results of Nutritional Intakes in the Study Areas

Based on their dietary habits as reported during data collection, the study populations in both Counties either meet or exceed their nutritional needs in both plenty and lean seasons. However, a distinction can be made between nutrients that are barely met and those that are well met (that is, significantly exceeded).

Nutrients that are barely met are similar in both Counties. They include energy, fat, Vitamin A, Vitamin B12, Iron, Calcium, and Zinc and to a lesser extent Vitamin B6.

In both counties, Iron is scarcely met for all individuals for the whole year; Vitamin B12 is barely met for women 15-49 years.For children 6-8 months, the requirement for Zinc balances out at the end of the two seasons; the children aged between 12-23 months have a challenge in meeting the requirements for Vitamin A, Vitamin B6 and Calcium.

In Kitui, children aged 12-23 months will barely obtain enough Vitamin B12 from this diet.A child 9-11 months will scarcely meet the zinc requirements for the whole year in Kitui, while in Taita Taveta, it will balance out. The requirement for Vitamin B2 for children 6-8 months Taita Taveta is eventually met at the end of both seasons.

Vitamin A requirement seems to be difficult to satisfy for women 15-49 years in Kitui County, while in Taita Taveta,this nutrient balances out for the same individuals.Vitamin C will ultimately be adequately met for women between 15-49 years in Kitui County at the end of one year.Calcium requirements for women 15-49 years in Kitui and Taita Taveta counties, respectively, were met sufficiently.

Tables 2 and 3 represent the nutritional intakes of the study populations for women aged between 15-49 years old with moderate activity levels and children 6-23 months, vis-à-vis their nutritional requirements. The data shows the average of the percentage nutrient requirements met throughout the year for Kitui and Taita Taveta Counties, respectively.Notably,some of the nutrient requirements met during the lean season of the year 2019 in both study areas are higher than in the plenty seasons of the2019. One possible

reason for this is the intervention of governmental and non-governmental agencies during the lean seasons in the form of food aid and / or the shifting of agricultural produce out of the study areas into more lucrative markets in the urban centres during the plenty seasons to obtain better margins for their produce.

TABLE 2: AVERAGE % NUTRIENT REQUIREMENTS MET THROUGHOUT THE YEAR-KITUI USING THE LACON DIET

KITUI		% energy	% protein	% fat	% vit A	% Vit C	% Vit B1	% vit B2	% niacin	% vit B6	% folic acid	% Vit B12	% calcium	% iron	% zinc
Whole Family	**Lean**	100	148	101	126	474	268	191	210	144	446	104	159	100	173
	Plenty	100	160	102	117	386	247	181	213	136	368	111	135	96	170
One Child (either sex) 6-8 months	**Lean**	100	238	114	241	924	298	304	194	301	498	168	250	92	113
	Plenty	100	261	118	170	572	208	181	145	228	483	191	166	53	100
One Child (either sex) 9-11 months	**Lean**	100	184	100	177	678	269	221	221	247	385	102	234	100	100
	Plenty	100	206	103	173	614	150	179	202	250	384	189	223	87	100
One Child (either sex) 12-23 months	**Lean**	100	146	100	102	239	191	143	169	100	431	100	100	100	100
	Plenty	100	168	100	101	241	191	136	160	100	426	100	100	100	100
One Female 15-16 years	**Lean**	100	148	100	100	601	260	184	199	138	381	100	152	100	152
	Plenty	100	150	100	100	609	259	186	201	138	369	100	150	100	152
One Female 17-18 years	**Lean**	100	143	100	100	594	262	185	200	138	389	100	152	100	153
	Plenty	100	146	100	100	607	260	187	202	139	370	100	149	100	154
One Woman, 18-29y, 60 kg	**Lean**	100	138	100	100	215	292	184	233	129	522	100	148	100	295
	Plenty	100	156	100	100	100	269	190	252	119	348	100	100	100	290
One Woman, 30-59y, 60 kg	**Lean**	100	136	100	100	235	286	180	230	127	501	100	152	100	284
	Plenty	100	154	100	100	100	262	184	247	116	336	100	104	100	277

TABLE 3: AVERAGE % NUTRIENT REQUIREMENTS MET THROUGHOUT THE YEAR-TAITATAVETA USING THE LACON DIET

TAITA		% energy	% protein	% fat	% Vit A	% Vit C	% Vit B1	% Vit B2	% niacin	% Vit B6	% folic acid	% Vit B12	% calcium	% iron	% zinc
Whole Family	**Lean**	100	152	101	100	588	314	180	222	155	312	192	111	100	296
	Plenty	100	150	100	171	471	249	204	212	164	384	183	144	100	181
1 x Child (either sex) 6-8 months	**Lean**	100	216	119	100	242	143	100	211	125	176	1,286	211	100	180
	Plenty	100	206	106	146	366	125	169	203	160	520	790	209	100	100
1 x Child (either sex) 9-11 months	**Lean**	100	174	100	100	278	228	126	215	132	379	403	153	100	158
	Plenty	100	194	100	152	348	182	183	227	160	560	761	208	100	100
1 x Child (either sex)12-23 months	**Lean**	100	158	100	100	319	192	133	175	100	252	156	100	100	100
	Plenty	100	148	100	100	223	192	145	172	100	427	149	100	100	100
1 x Female 15-16 years	**Lean**	100	151	100	100	900	336	203	207	170	323	100	100	100	314
	Plenty	100	154	100	186	618	258	216	184	170	366	100	128	100	197
1 x Female 17-18 years	**Lean**	100	147	100	100	898	337	204	208	171	324	100	100	100	314
	Plenty	100	150	100	187	621	260	217	185	171	367	100	128	100	198
1 x Woman, 18-29y, 60 kg	**Lean**	100	147	100	100	617	356	194	252	159	322	100	100	100	456
	Plenty	100	138	100	196	488	282	216	254	171	365	100	149	100	261
1 x Woman, 30-59y, 60 kg	**Lean**	100	145	100	100	623	351	191	249	157	317	100	100	100	458
	Plenty	100	137	100	203	508	277	216	250	171	361	100	151	100	259

The nutrient needs vary depending on the age, sex and amount of physical activity of the individual in question

4.1.2 LACON Diets in the Study Areas

Tables4 and 5show the compositions of LACON diets in both counties for the year. This data is broken down in Tables6 to 9 to display the same information for the lean and plenty seasons. The tables show the composition of LACON diets by weight (in kilograms) and the contributions of the various components to the cost of the diet in the US Dollar (USD) equivalent over a season. The analysis in this section focuses on composition by weight.

The following foods feature prominently in Taita County: Avocado provides a good portion of the fat requirement. Small Dried Fish is a major source of Vit B12.Amaranth Leaf being a key vegetable contributing considerably towards Vitamin A, Vitamin C, Calcium, and Iron.Pork provides almost a quarter of the iron and a third of zinc.Wheat flour seems to contain many of the nutrients in considerable amounts Energy, Protein, Vitamin A, Vitamin B1, Vitamin B2, Niacin, Folic Acid, Vitamin B12, Iron, and Zinc. Finger Millet grain provides Energy, Protein, Niacin, Vitamin B6, Folic Acid, Calcium, Iron, Zinc.

While in Kitui County, the following foods are conspicuous in their contribution to the diet.Egg provides the following nutrients Vitamin A, Vitamin B12, Iron and zinc.Vegetable fat is the main source of fat.Spinach provides some Vitamin A and Vitamin C.Refined wheat flour contributes to a large extent the following nutrients Energy, Protein, Vitamin A, Vitamin B1, Vitamin B2, Niacin, Folic Acid, Vitamin B12, Iron, and Zinc. Finger Millet grain amply supplies Energy, Protein, Niacin, Vitamin B6, Folic Acid, Calcium, Iron, and Zinc.

The LACON Diet on Table4 to 9shows that energy-giving foods dominate the diet in the two Counties. In the lean season, these include, finger millet grain, wheat flour, green maize, maize flour (Kitui County) and dried maize (Taita Taveta County). In the plenty season, the dominant components of the LACON diet are finger millet grain, wheat flour, green maize (Kitui County) and maize flour (Taita Taveta County). These foods account for 43.3% and 46% of the diet by weight in Taita and Kitui County, respectively.

The main sources of micronutrients (vitamins and minerals) are vegetables; kale is the predominant one in all seasons and counties except for Taita Taveta which features amaranth (19.3%) as the main source during the plenty season. Other vegetables that contribute to the diet, though to a lesser extent, are black nightshade for Taita Taveta County; leaf amaranth, cowpea leaf, spinach, and tomato for Kitui County. Meanwhile, the main sources of fats and

oils are vegetable cooking fat and corn oil. Nevertheless, avocado is a significant source of this macronutrient in Taita Taveta County providing 36.8% during the plenty season.

A major difference between the two Counties is in the role of pork as a source of minerals- mainly iron and zinc- in Taita Taveta County, particularly during the lean season while egg is a key source of Vitamin B12 in Kitui County throughout the year. It seems that the limited availability of leafy vegetables and the associated price increases force many households to consider pork as an alternative. The only source of meat selected by the software in Kitui County is goat notwithstanding its small contribution of 0.2% towards the diet in terms of weight and, consequently, its negligible supply of nutrients.

One makes some interesting observations as Taita Taveta residents transition from the lean to the plenty season. Finger millet starts to play a greater role in the diet, contributing close to 13% up from less than 5% in the lean season. Kale reduces significantly from the diet as it is replaced by amaranth leaf. Fruits also appear in the diet, with avocado making up close to 10% of the diet. Sugarcane also emerges into the diet, supplying trace amounts of energy, vitamins, and minerals.

In Kitui County, the software picked one more vegetable during the lean season -kales, spinach, tomato, amaranth, cowpea leaf- compared to the plenty season - carrot, kales, spinach and tomato. This region has more variety of vegetables (kales, spinach, amaranth leaf, carrot, cowpea leaf and tomato) than Taita Taveta County (Kale, amaranth, black nightshade). Egg is maintained throughout the seasons as an unrivalled food item.

TABLE 4: THE EDIBLE WEIGHT AND COST OF THE FOODS SELECTED FOR THE WHOLE FAMILY FOR THE WHOLE YEAR FOR A FOOD HABITS NUTRITIOUS DIET - TAITATAVETA

The edible weight and cost of foods selected for the family for the whole year for a food habits nutritious diet with the percentage contributed by each food in terms of weight, cost, energy, protein, and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total target for each nutrient, average across the season in the Rural Zone livelihood

Food list	Quantity (Kg)	% quantity	Cost (USD)	% Cost	% energy	% protein	% Fat	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic Acid	% vit B12	% calcium	% iron	% Zinc
(Avocado (Kenya))	117.0	5.1	65.8	5.2	4.8	1.5	18.4	0.1	3.3	1.4	4.6	3.6	8.5	3.2	0.0	0.8	1.1	1.4
(Breast Milk)	639.0	27.8	0.0	0.0	9.2	5.4	20.1	18.9	5.1	2.4	5.8	4.7	1.7	2.2	7.6	6.5	0.0	2.4
(Fat, vegetable, cowboy, kapra ot kimbo)	14.0	0.6	21.7	1.7	2.8	0.0	11.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Fish, small, dried, fresh water (Kenya))	9.0	0.4	38.8	3.1	0.7	4.4	0.8	0.8	0.0	0.6	1.2	2.8	1.1	0.2	67.4	9.3	3.0	4.6
(Kale, raw (Kenya))	193.0	8.4	114.6	9.1	1.2	4.7	0.5	20.3	51.5	3.8	6.5	3.3	14.7	4.9	0.0	28.2	5.1	3.0
(Leaf, amaranth, raw (Kenya))	235.0	10.2	136.6	10.8	1.9	7.0	0.4	45.3	36.0	1.2	13.4	2.8	12.5	6.2	0.0	23.9	15.0	6.8
(Leaf, amaranth, raw-black nightshade (Kenya))	18.0	0.8	16.2	1.3	0.1	0.5	0.0	0.0	1.3	0.2	1.5	0.3	0.9	2.9	0.0	0.6	1.4	0.4
(Maize, dried raw)	229.0	10.0	121.9	9.6	18.3	15.0	6.6	0.0	0.0	15.8	11.9	17.8	19.3	2.4	0.0	0.5	7.6	13.0
(Maize, flour, dry)	122.0	5.3	76.5	6.0	9.7	8.0	3.5	0.0	0.0	8.4	6.3	9.4	10.3	1.3	0.0	0.3	4.0	6.9
(Maize, green,raw)	113.0	4.9	60.0	4.7	5.1	5.7	2.3	0.0	2.7	8.4	3.8	7.4	3.8	4.1	0.0	0.2	1.3	3.6
(Maize, white flour, refined (Kenya))	7.0	0.3	4.9	0.4	0.6	0.4	0.2	0.3	0.0	0.6	0.6	0.4	0.7	1.5	0.0	0.1	0.2	1.0
(Millet, finger, flour (Kenya))	3.0	0.1	4.5	0.4	0.2	0.2	0.1	0.0	0.0	0.1	0.0	0.3	0.2	0.1	0.0	0.4	0.4	0.2
(Millet, finger, grain, dried, raw (Kenya))	200.0	8.7	193.4	15.3	13.4	11.9	3.1	0.0	0.0	6.7	2.1	15.7	12.9	7.7	0.0	25.0	21.3	10.7
(Oil, corn)	26.0	1.1	40.7	3.2	5.0	0.0	20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Pork, meat, raw (Kenya))	37.0	1.6	144.3	11.4	2.3	5.7	7.0	0.0	0.0	4.1	1.6	2.4	5.2	0.1	2.7	0.0	22.8	32.8
(Salt iodized)	3.0	0.1	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Sugarcane juice (Kenya))	15.0	0.7	1.7	0.1	0.1	0.0	0.0	0.0	0.2	0.1	0.2	0.0	0.0	0.3	0.0	0.1	0.2	0.1
Wheat flour, refined (Kenya))	259.0	11.3	173.0	13.7	19.9	23.5	3.3	14.3	0.0	41.8	38.4	26.1	2.9	61.5	22.3	3.3	13.7	7.1
Wheat grain or flour, CotD (Kenya))	63.0	2.7	48.5	3.8	4.6	5.9	1.3	0.0	0.0	4.4	2.1	2.9	5.2	1.5	0.0	0.9	2.9	6.0
Total	2,302	100	1,264	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% target met					100	151	101	136	529	281	192	217	160	349	187	128	100	238

TABLE 5: THE EDIBLE WEIGHT AND COST OF THE FOODS SELECTED FOR THE WHOLE FAMILY FOR THE WHOLE YEAR FOR AN FOOD HABITS NUTRITIOUS DIET- KITUI

The edible weight and cost of foods selected for the family for the whole year for a food habits nutritious diet with the percentage contributed by each food in terms of weight, cost, energy, protein, and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total target for each nutrient, average across the season in the Rural Zone livelihood

Food list	Quantity (Kg)	% quantity	Cost (USD)	% Cost	% energy	% protein	% Fat	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic Acid	% vit B12	% calcium	% iron	% Zinc
(Avocado (Kenya))	6.0	0.3	6.2	0.4	0.2	0.1	1.0	0.0	0.2	0.1	0.2	0.2	0.5	0.1	0.0	0.0	0.1	0.1
(Breast milk)	639.0	28.3	0.0	0.0	9.2	5.3	20.0	21.2	6.3	2.6	6.0	4.8	1.9	1.9	13.3	5.6	0.0	3.4
(Carrot, raw (Kenya))	9.0	0.4	11.4	0.7	0.1	0.0	0.0	3.4	0.1	0.1	0.1	0.0	0.4	0.1	0.0	0.1	0.1	0.1
(Coffee, ground, dry)	< 1	0.0	4.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
(Coriander, leaf, raw (Kenya))	< 1	0.0	2.5	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cowpea, dried, raw (Kenya))	6.0	0.3	5.2	0.3	0.4	1.2	0.1	0.0	0.0	1.1	0.2	0.3	0.7	0.9	0.0	0.2	0.3	0.9
(Egg, whole, raw (Kenya))	132.0	5.9	432.0	27.1	3.9	13.3	8.6	16.5	0.0	3.1	18.1	0.0	7.2	3.9	48.2	2.3	10.8	6.5
(Fat, vegetable, cowboy, kapra or kimbo)	47.0	2.1	54.8	3.4	9.2	0.0	38.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Ginger root, raw (Kenya))	< 1	0.0	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Goat, raw)	4.0	0.2	24.3	1.5	0.2	0.6	0.4	0.0	0.0	0.0	0.1	0.4	0.3	0.0	1.2	0.0	0.2	0.5
(Green gram, whole, dried, raw (Kenya))	3.0	0.1	2.2	0.1	0.2	0.5	0.0	0.0	0.0	0.3	0.1	0.1	0.4	0.5	0.0	0.1	0.2	0.3
(Kale, raw (Kenya))	226.0	10.0	165.4	10.4	1.4	5.4	0.5	26.5	74.1	4.8	7.9	3.9	19.5	4.9	0.0	28.6	6.1	4.9
(Leaf, amaranth, raw (Kenya))	30.0	1.3	53.6	3.4	0.2	0.9	0.0	6.4	5.6	0.2	1.7	0.4	1.8	0.7	0.0	2.6	1.9	1.2
(Leaf, cowpea, raw (Kenya))	35.0	1.6	27.1	1.7	0.2	1.0	0.1	0.8	4.3	3.4	3.5	1.0	2.0	1.2	0.0	0.7	0.7	1.5
(Maize, green, raw)	131.0	5.8	63.4	4.0	6.0	6.6	2.6	0.0	3.9	10.7	4.6	8.8	5.1	4.1	0.0	0.2	1.5	5.7
(Maize, white, flour, refined (Kenya))	65.0	2.9	38.9	2.4	5.0	3.5	1.6	3.0	0.0	6.3	5.4	4.2	7.7	11.9	0.0	0.4	2.2	12.3
(Millet, bulrush)	106.0	4.7	84.6	5.3	8.4	9.8	4.3	0.7	0.0	5.3	6.5	10.2	9.9	1.2	0.0	1.4	8.2	14.4
(Millet, finger, grain, dried, raw (Kenya))	488.0	21.6	367.0	23.0	32.8	28.6	7.4	0.0	0.0	18.0	5.2	39.3	36.0	16.0	0.0	53.0	53.2	36.3
(Oil, corn)	15.0	0.7	24.1	1.5	2.9	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Salt, iodized)	< 1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Spinach, raw (Kenya))	44.0	2.0	38.9	2.5	0.3	1.0	0.1	5.5	4.0	0.3	2.1	0.3	2.8	1.7	0.0	1.8	0.7	1.9
Tomato, red, ripe, raw (Kenya))	23.0	1.0	22.0	1.4	0.1	0.2	0.0	0.4	1.4	0.2	0.2	0.2	0.6	0.2	0.0	0.1	0.2	0.4
(Wheat, flour, refined (Kenya))	249.0	11.0	165.7	10.4	19.1	22.1	3.2	15.3	0.0	43.8	38.0	25.7	3.2	50.6	37.3	2.7	13.4	9.5
Total	2,259	100	1,594.83	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% target met					100	154	101	121	430	257	186	212	140	407	107	147	98	172

TABLE 6: THE EDIBLE WEIGHT AND COST OF THE FOODS SELECTED FOR THE WHOLE FAMILY FOR THE LEAN SEASON FOR AN FHAB DIET-TAITA TAVETA

The edible weight and cost of foods selected for the family for one season for a food habits nutritious diet with the percentage contributed by each food in terms of weight, cost, energy, protein, and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total target for each nutrient, for Season 1 (Lean) in the Rural Zone livelihood.

Food list	Quantity (Kg)	% quantity	Cost (USD)	% Cost	% energy	% protein	% Fat	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic Acid	% vit B12	% calcium	% iron	% Zinc
(Breast milk)	639.0	29.2	0.0	0.0	9.2	5.4	20.0	25.7	4.6	2.1	6.2	4.6	1.7	25.0	7.4	7.5	0.0	1.9
(Fish, small, dried, fresh water (Kenya))	9.0	0.4	39.6	3.1	0.7	4.3	0.8	1.0	0.0	0.5	1.3	2.8	1.1	0.2	65.5	10.6	3.0	3.7
(Kale, raw (Kenya))	378.0	17.3	223.8	17.7	2.4	9.1	0.9	53.9	90.7	6.6	13.6	6.3	29.5	10.8	0.0	63.5	10.0	4.8
(Maize, dried, raw)	462.0	21.1	245.9	19.4	36.9	30.1	13.3	0.0	0.0	28.6	25.6	35.1	40.1	5.3	0.0	1.2	15.3	21.1
(Maize, green, raw)	219.0	10.0	116.1	9.2	10.0	11.1	4.4	0.0	4.7	14.6	7.9	14.0	7.6	8.9	0.0	0.4	2.5	5.6
(Millet, finger, grain, dried, raw (Kenya))	91.0	4.2	95.6	7.5	6.1	5.4	1.4	0.0	0.0	2.7	1.0	7.0	6.1	3.9	0.0	13.1	9.7	3.9
(Oil, corn)	52.0	2.4	81.8	6.5	10.2	0.0	41.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Pork, meat, raw (Kenya))	75.0	3.4	291.1	23.0	4.7	11.4	14.1	0.0	0.0	7.5	3.5	4.8	10.9	0.1	5.4	0.0	46.0	53.3
(Salt iodized)	3.0	0.1	1.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Wheat, flour, refined (Kenya))	258.0	11.8	172.6	13.6	19.9	23.2	3.3	19.3	0.0	37.3	40.8	25.4	3.0	68.4	21.7	3.8	13.6	5.7
Total	2,186	100	1,267.88	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% target met					100	152	101	100	588	314	180	222	155	312	192	111	100	296

TABLE 7:THE EDIBLE WEIGHT AND COST OF THE FOODS SELECTED FOR THE WHOLE FAMILY FOR THE PLENTY SEASON FOR AN FHAB DIET-TAITA TAVETA

The edible weight and cost of foods selected for the family for one season for a food habits nutritious diet with the percentage contributed by each food in terms of weight, cost, energy, protein, and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total target for each nutrient, for Season 2 (Plenty) in the Rural Zone livelihood.

Food list	Quantity (Kg)	% quantity	Cost (USD)	% Cost	% energy	% protein	% Fat	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic Acid	% vit B12	% calcium	% iron	% Zinc
(Avocado (Kenya))	232.0	9.6	130.5	10.4	9.5	3.0	36.8	0.2	7.3	3.2	8.5	7.3	16.5	5.8	0.0	1.4	2.2	3.7
(Breast Milk)	639.0	264.0	0.0	0.0	9.2	5.5	20.2	15.0	5.7	2.7	5.5	4.8	1.6	2.0	7.8	5.8	0.0	3.2
(Fat, vegetable, cowboy, kapra ot kimbo)	29.0	1.2	49.2	3.4	5.6	0.0	23.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Fish, small, dried, fresh water (Kenya))	9.0	0.4	38.0	3.0	0.7	4.5	0.8	0.6	0.0	0.6	1.2	2.9	1.0	0.2	69.3	8.3	3.0	6.1
(Kale, raw (Kenya))	11.0	0.5	7.1	0.6	0.1	0.3	0.0	0.1	3.4	0.3	0.4	0.2	0.8	0.3	0.0	1.5	0.3	0.2
(Leaf, amaranth, raw (Kenya))	465.0	19.3	290.4	21.5	3.7	14.0	0.8	71.3	80.1	2.8	25.0	5.6	24.2	11.1	0.0	42.0	29.8	17.7
(Leaf, amaranth, raw-black nightshade (Kenya))	35.0	1.4	32.1	2.5	0.2	1.1	0.0	0.0	2.8	0.4	2.7	0.7	1.8	5.3	0.0	1.1	2.8	0.9
(Maize, flour, dry)	241.0	10.0	151.7	12.0	19.2	15.9	7.0	0.0	0.0	18.8	11.8	19.1	19.8	2.3	0.0	0.5	8.0	18.0
(Maize, green,raw)	8.0	0.3	4.9	0.4	0.4	0.4	0.2	0.0	0.2	0.7	0.2	0.5	0.3	0.3	0.0	0.0	0.1	0.3
(Maize, white flour, refined (Kenya))	14.0	0.6	9.8	0.8	1.1	0.8	0.3	0.5	0.0	1.4	1.1	0.9	1.4	2.7	0.0	0.1	0.5	2.5
(Millet, finger, flour (Kenya))	7.0	0.3	8.9	0.7	0.4	0.4	0.1	0.0	0.0	0.2	0.1	0.5	0.4	0.2	0.0	0.7	0.7	0.5
(Millet, finger, grain, dried, raw (Kenya))	307.0	12.7	289.5	23.0	20.7	18.5	4.7	0.0	0.0	11.7	3.0	26.4	19.3	10.7	0.0	34.0	32.7	21.6
(Oil, corn)	< 1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Salt iodized)	3.0	0.1	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Sugarcane juice (Kenya))	30.0	1.2	3.3	0.3	0.2	0.0	0.0	0.0	0.4	0.2	0.3	0.1	0.0	0.5	0.0	0.1	0.3	0.2
Wheat flour, refined (Kenya))	260.0	10.8	173.3	13.8	20.0	23.8	3.4	11.4	0.0	47.3	36.3	26.8	2.8	56.1	22.9	2.9	13.8	9.4
Wheat grain or flour, CotD (Kenya))	125.0	5.2	96.2	7.6	9.1	11.9	2.5	0.0	0.0	9.8	4.0	5.9	10.0	2.7	0.0	1.6	5.8	15.6
Total	2,415	100	1,260.54	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% target met					100	150	100	171	471	249	204	212	164	384	144	100	100	181

TABLE 8: THE EDIBLE WEIGHT AND COST OF THE FOODS SELECTED FOR THE WHOLE FAMILY FOR THE LEAN SEASON FOR AN FHAB DIET-KITUI

The edible weight and cost of foods selected for the family for one season for a food habits nutritious diet with the percentage contributed by each food in terms of weight, cost, energy, protein, and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total target for each nutrient, for Season 1 (Lean) in the Rural Zone livelihood.

Food list	Quantity (Kg)	% quantity	Cost (USD)	% Cost	% energy	% protein	% Fat	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic Acid	% vit B12	% calcium	% iron	% Zinc
(Avocado (Kenya))	12.0	0.5	12.5	0.8	0.5	0.2	1.9	0.0	0.4	0.2	0.5	0.4	1.0	0.3	0.0	0.1	0.1	0.0
(Breast milk)	639.0	27.9	0.0	0.0	9.2	5.5	20.0	20.4	5.7	2.5	5.8	4.9	1.9	1.7	13.7	5.2	0.0	3.3
(Coffee, ground, dry)	< 1	0.0	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
(Coriander, leaf, raw (Kenya))	< 1	0.0	1.3	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Egg, whole, raw (Kenya))	126.0	5.5	460.0	28.8	3.7	13.3	8.2	15.2	0.0	2.8	16.8	0.0	6.7	3.4	47.5	2.0	10.2	6.2
(Fat, vegetable, cowboy, kapra or kimbo)	47.0	2.1	66.5	4.2	9.2	0.0	37.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Kale, raw (Kenya))	234.0	10.2	201.6	12.6	1.5	5.8	0.6	26.5	69.6	4.8	7.9	4.1	19.7	4.7	0.0	27.4	6.2	5.1
(Leaf, amaranth, raw (Kenya))	60.0	2.6	108.0	6.8	0.5	1.8	0.1	12.5	10.2	0.3	3.4	0.7	3.5	1.2	0.0	4.9	3.9	2.4
(Leaf, cowpea, raw (Kenya))	71.0	3.1	54.9	3.4	0.5	2.0	0.2	1.6	7.9	6.5	6.9	20.0	4.0	2.2	0.0	1.3	1.3	3.1
(Maize, green, raw)	128.0	5.6	62.7	3.9	5.8	6.7	2.6	0.0	3.4	10.0	4.3	8.7	4.8	3.6	0.0	0.1	1.5	5.6
(Maize, white, flour, refined (Kenya))	114.0	5.0	67.6	4.2	8.8	6.4	2.7	5.2	0.0	10.5	9.2	7.4	13.1	19.1	0.0	0.7	3.9	21.5
(Millet, bulrush)	14.0	0.6	7.9	0.5	1.1	1.4	0.6	0.1	0.0	0.7	0.8	1.4	1.3	0.1	0.0	0.2	1.1	1.9
(Millet, finger, grain, dried, raw (Kenya))	542.0	23.7	312.5	19.6	36.4	33.1	8.3	0.0	0.0	19.1	5.7	44.0	38.9	16.2	0.0	54.4	58.1	40.0
(Oil, corn)	17.0	0.7	27.5	1.7	3.3	0.0	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Salt, iodized)	< 1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Spinach, raw (Kenya))	28.0	1.2	35.4	2.2	0.2	0.7	0.1	3.4	2.3	0.2	1.3	0.2	1.8	1.0	0.0	1.1	0.5	1.2
Tomato, red, ripe, raw (Kenya))	8.0	0.3	7.7	0.5	0.0	0.1	0.0	0.1	0.4	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.1	0.1
(Wheat, flour, refined (Kenya))	250.0	10.9	165.7	10.4	19.3	23.2	3.2	14.9	0.0	42.3	37.2	26.0	3.1	46.4	38.8	2.6	13.3	9.4
Total	2,292	100	1,595.47	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% target met					100	148	101	126	474	268	191	210	144	446	104	159	100	173

TABLE 9: THE EDIBLE WEIGHT AND COST OF THE FOODS SELECTED FOR THE WHOLE FAMILY FOR THE PLENTY SEASON FOR AN FHAB DIET - KITUI

The edible weight and cost of foods selected for the family for one season for a food habits nutritious diet with the percentage contributed by each food in terms of weight, cost, energy, protein, and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total target for each nutrient, for Season 2 (Plenty) in the Rural Zone livelihood.

Food list	Quantity (Kg)	% quantity	Cost (USD)	% Cost	% energy	% protein	% Fat	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic Acid	% vit B12	% calcium	% iron	% Zinc
(Breast milk)	639.0	28.7	0.0	0.0	9.2	5.1	19.9	22.0	7.0	2.7	6.1	4.8	2.0	2.1	12.9	6.1	0.0	3.4
(Carrot, raw (Kenya))	17.0	0.8	22.7	1.4	0.1	0.1	0.0	7.0	0.3	0.1	0.1	0.1	0.8	0.1	0.0	0.2	0.1	0.1
(Coffee, ground, dry)	< 1	0.0	4.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
(Coriander, leaf, raw (Kenya))	< 1	0.0	3.6	0.2	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cowpea, dried, raw (Kenya))	12.0	0.5	10.3	0.6	0.8	2.3	0.1	0.0	0.0	2.2	0.5	0.5	1.4	2.0	0.0	0.5	0.7	1.8
(Egg, whole, raw (Kenya))	138.0	6.2	404.4	25.4	4.1	13.4	8.9	17.8	0.0	3.3	19.3	0.0	7.7	4.5	48.8	2.6	11.5	6.9
(Fat, vegetable, cowboy, kapra or kimbo)	48.0	2.1	43.3	2.7	9.3	0.0	38.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Ginger root, raw (Kenya))	< 1	0.0	1.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Goat, raw)	8.0	0.4	48.2	3.0	0.3	1.1	0.8	0.0	0.0	0.1	0.3	0.8	0.6	0.0	2.3	0.0	0.5	1.1
(Green gram, whole, dried, raw (Kenya))	5.0	0.2	4.3	0.3	0.3	1.0	0.1	0.0	0.0	0.5	0.3	0.2	0.8	1.2	0.0	0.3	0.4	0.6
(Kale, raw (Kenya))	218.0	9.8	129.7	8.1	1.4	5.0	0.5	26.6	79.6	4.8	7.8	3.8	19.4	5.3	0.0	30.0	6.0	4.8
(Maize, green, raw)	135.0	6.0	66.2	4.0	6.1	6.5	2.7	0.0	4.4	11.4	4.8	9.0	5.3	4.6	0.0	0.2	1.6	5.9
(Maize, white, flour, refined (Kenya))	17.0	0.7	10.7	0.7	1.3	0.9	0.4	0.8	0.0	1.7	1.4	1.1	2.0	3.4	0.0	0.1	0.6	3.2
(Millet, bulrush)	196.0	8.8	160.0	10.0	15.6	17.4	7.9	1.4	0.0	10.3	12.4	18.8	18.8	2.5	0.0	2.8	15.4	26.9
(Millet, finger, grain, dried, raw (Kenya))	435.0	19.5	420.5	26.4	29.3	24.5	6.6	0.0	0.0	16.7	4.8	34.8	33.0	15.8	0.0	51.4	48.3	32.7
(Oil, corn)	13.0	0.6	20.7	1.3	2.6	0.0	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Salt, iodized)	< 1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Spinach, raw (Kenya))	60.0	2.7	43.4	2.7	0.4	1.3	0.2	7.8	6.0	0.4	3.0	0.4	3.9	2.6	0.0	2.7	1.0	2.6
Tomato, red, ripe, raw (Kenya))	38.0	1.7	35.8	2.2	0.2	0.3	0.1	0.7	2.6	0.3	0.4	0.3	1.0	0.0	0.0	0.1	0.3	0.6
(Wheat, flour, refined (Kenya))	247.0	11.1	165.7	10.4	19.0	21.1	3.2	15.8	0.0	45.4	38.7	25.3	3.3	55.6	36.0	0.3	13.6	9.5
Total	2,228	100	1,594.21	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% target met					100	160	102	117	386	247	181	213	136	368	111	135	96	170

4.1.3 The Shares of Various Food Groups in Total Diet Costs

Table 10 shows the average weekly cost of the Kitui LACON diet broken down by food group for the two seasons. Table 11 does the same for Taita Taveta. As is evident form the Table, grains and grain-based products take the lion's share of the dietary budget, about 39%-52% for Kitui County and 50%-58% for Taita Taveta County. Vegetable and vegetable products take up a considerable budget throughout the year in both counties 27% and 21.5% for Kitui and Taita Taveta Counties respectively.

TABLE 10: SUMMARY OF THE AVERAGE WEEKLY COST OF FOODS FOR A FOOD HABITS

TAITA	Season 1 (Lean) (USD)		Season 2 (Plenty) (USD)	
Grains and grain-based products	12.08	50%	14.08	58%
Meat and offal	5.58	23%		
Fish, seafood, amphibians, and invertebrates	0.75	3%	0.72	3%
Vegetables and vegetable products	4.29	18%	5.94	25%
Fruit and fruit products			2.50	10%
Oils and fats	1.56	6%	0.82	3%
Sugars and confectionary			0.06	0%
Herbs, spices, and condiments	0.02	0%	0.02	0%
Total	24.31	100%	24.17	100%

NUTRITIOUS DIET FOR THE FAMILY

TABLE 11: SUMMARY OF THE AVERAGE WEEKLY COST OF FOODS SELECTED BY SEASON BY THE COST OF THE DIET SOFTWARE FOR A FOOD HABITS NUTRITIOUS DIET FOR THE FAMILY

KITUI	Season 1 (Lean) (USD)		Season 2 (Plenty) (USD)	
Grains and grain-based products	11.82	39%	15.74	52%

Legumes, nuts, and seeds			0.27	1%
Meat and offal			0.92	3%
Eggs and egg products	8.82	29%	7.75	25%
Vegetables and vegetable products	7.66	25%	3.75	12%
Fruit and fruit products	0.39	1%	0.68	2%
Oils and fats	1.80	6%	1.22	4%
Herbs, spices, and condiments	0.02	0%	0.10	0%
Beverages	0.06	0%	0.08	0%
Total	30.59	100%	30.57	100%

Meat and offal accounts for 23% of the budget in Taita Taveta County during the lean season, while in Kitui, it takes up only 3% of the budget during the plenty season.Egg and Egg Products cost 29% and 25% of the budget during the lean and plenty season, respectively, in Kitui County.

Fruit and fruit products take up 10% of the budget for Taita Taveta county during the plenty season. In Kitui, it takes up an insignificant amount of 1% and 2% during the lean and plenty season.

Legumes, nuts, and seeds cost 1% of the budget during plenty seasons in Kitui.Oil and fats take up between 3%-6% of the budget in both Counties throughout the year.Fish, seafood, amphibians and invertebrate's costs 3% of the budget in Taita Taveta during both seasons.Herbs, spices, and condiments for both counties,Sugars, and confectionary for Taita Taveta and Beverages for Kitui take up a negligible share of the budget.

4.2 Modelling the Costs of the Locally Adapted Cost-Optimised Nutritious Diets

TABLE 12: THE FOUR TYPES OF DIETS MODELLED

Diet Name	Requirements Met	Foods Selected by Software		Food Groups		Avg Daily Cost (USD)	
		Taita	**Kitui**	**Taita**	**Kitui**	**Taita**	**Kitui**
Energy only diet (EO)	Yes	4	4	3	3	1.81	1.55
Macronutrients diet (MAC)	Yes	7	5	4	4	1.83	1.59
Nutritious diet (NUT)	Yes	14	15	7	8	3.30	3.92
Food habits nutritious diet (FHAB)/LACON diet	Yes	19	23	9	10	3.46	4.36

Energy-only Diet

The EO diet is USD 1.799for Taita Tavetaand USD 1.55for Kitui for one day, regardless of the season for the family. The software selects four types of foods from 3 food groups. The software selected dried, raw, maize as the key food. The EO diet lacks sufficient nutrients necessary for maintaining a vibrant health. It is included in the analysis to help us understand the extra cost of meeting all nutritional specifications.

Macronutrients Diet

A MAC diet costsUSD 1.83 for TaitaTaveta and USD 1.59for Kitui per day average for both seasons. The software selected 7 kinds of food for Taita Tavetaand 5 for Kitui from 4 food groups.

Nutritious Diet

The NUT Diet costsUSD 3.29for Taita Tavetaand USD 3.91for Kitui calculated as an average daily cost for both seasons. The software selected 14 kinds of foods for Taita Tavetaand 15 for Kitui from 7 and 8 food groups respectively.

Food habits Nutritious Diet/ LACON Diet

The FHAB/LACON costs a minimum ofUSD 3.46 and USD 4.36for Taita Tavetaand Kitui, respectively, for a family of seven.

The food list created by the software for the FHAB Diet contains 18 foods out of 110 foods consumed by the locals in Taita Tavetaand 22 foods out of 78 foods consumed by locals in Kitui. Breast milk is one food always included for infants but not recorded during the market survey, thus the number 19 for Taita Tavetaand 23 for Kitui.

It is interesting to note that the Energy and macronutrient diets are more expensive in Taita Tavetathan in Kitui, while the nutritious and food habits nutritious diets costs more in Kitui County compared to Taita Taveta.

There is anegligible difference of only USD 0.03between the energy-onlyand macronutrient diets in both counties. Conversely, there is a remarkable leap from the macronutrients diet to the nutritious diet, an additional USD 1.46 and USD 2.32 for Taita Tavetaand Kitui County,

respectively. Finally, the constraints placed on the nutritious diet causes an increase of the cost of the diet by USD 0.16 in Taita Tavetaand USD 0.44 in Kitui.

4.2.1 Daily, monthly, and yearly costs of LACON diets

With this understanding in mind, Tables 13 and 14 show the costs of LACON diets in Kitui and Taita Taveta, respectively, as modelled in the software.On average, for every family consisting of 7 individuals, a LACON diet costs USD 4.36per day, USD 132.60 per month and USD 1,591.22a year for Kitui and USD 3.46per day,USD 105.11per month and USD 1,261.37a year for Taita Taveta.

The diet costs about USD 0.01 more in the plenty season than it does in the lean season for Taita Taveta, while in Kitui the difference in the daily cost is negligible. This phenomenon is probably attributable to new and/ or existing social protection schemes that boost the supply of processed and nutritionally fortified food items in semi-arid regions of the country during the lean season. The exact role of such interventions in regards to promotion of food security is a ripe field of research that can yield valuable insights for more sustainable government interventions in the regions geared to food security.

At average costs of USD 3.46 per day,USD 105.11 a month and USD 1,261.37a year, the LACON diet in Taita Taveta is about 20% cheaper than Kitui's.

That diet comprises 7 to 12 food items (depending on the season) drawn from the food groups: Grains and grain-based products; Meat and offal; Vegetables and vegetable products; Fruit and fruit products; Oil and fats and Herbs, spices, and condiments for both Counties, then, Fish, seafoods, amphibians and invertebrates; and Sugars and confectionary for Taita Taveta and, Eggs and egg products; Legumes, nuts, and seeds; andBeverages for Kitui.

Tables13 and 14 are helpful in better visualising how the daily cost of the LACON diet varies across the two seasons. While the price difference in Table14 (Taita Taveta) is noticeable, that of Table13 (Kitui) is barely noticeable.

TABLE 13: COST OF THE LACON DIET IN KITUI

	Season 1 (Lean) 181 days			Season 2 (Plenty) 184 days			Annual Cost (USD)	Average Daily Cost (USD)	Average Monthly Cost (USD)
	Daily cost (USD)	No. of foods	Food groups	Daily cost (USD)	No of foods	Food groups			
1 x Child (either sex) 6 - 8 months	0.55	11	7	0.35	12	8	166.85	0.45	13.9
1 x Child (either sex) 9 - 11 months	0.35	7	5	0.41	10	8	141.68	0.38	11.8
1 x Child (either sex) 12- 23 months	0.15	9	6	0.15	9	6	56.49	0.15	4.7
1 x Female 15-16 years	0.86	9	4	0.19	8	4	320.66	0.87	26.72
1 x Female 17-18 years	0.86	9	4	0.88	8	4	320.6	0.87	26.71
1 x Woman 18-29 years, 60kg, moderately active	0.78	8	4	0.82	9	4	294.15	0.8	24.51
1 x Woman 30-59 years, 60kg, moderately active	0.78	8	4	0.82	8	4	294.38	0.8	24.72
Total	4.37	18	8	4.36	20	20	1,594.84	4.38	132.9

Note: The daily costs for the individuals 1x child (either sex 6-8 months), 1x child (either sex 9-11 months), and ultimately affecting the cost of the household shows that the nutrient specifications have not been met by the diet modelled by CoD Software.

TABLE 14: COST OF THE LACON DIET IN TAITA TAVETA

	Season 1 (Lean) 181 days			Season 2 (Plenty) 184 days			Annual Cost (USD)	Average Daily Cost (USD)	Average Monthly Cost (USD)
	Daily cost (USD)	No. of foods	Food groups	Daily cost (USD)	No of foods	Food groups			
1 x Child (either sex) 6 - 8 months	0.17	8	6	0.18	7	5	66.83	0.18	5.56
1 x Child (either sex) 9 - 11 months	0.17	8	6	0.18	10	7	65.66	0.17	5.47
1 x Child (either sex) 12- 23 months	0.15	10	7	0.15	10	7	56.19	0.15	4.68
1 x Female 15-16 years	0.76	9	6	0.74	11	7	276.51	0.75	23.04
1 x Female 17-18 years	0.76	9	6	0.74	12	7	276.77	0.75	23.06
1 x Woman 18-29 years, 60kg, moderately active	0.71	9	6	0.71	9	7	261.82	0.71	22.78
1 x Woman 30-59 years, 60kg, moderately active	0.7	9	6	0.71	9	7	262.26	0.71	22.77
Total	3.47	10	7	3.45	17	8	1,264.23	3.46	105.35

5 DISCUSSION

The market surveys undertaken for this study revealed that Taita Taveta has a wider variety of locally available food items (111 against 79 in Kitui). The 111 food items in Taita Taveta were identified by eighteen traders, while the 79 food items in Kitui were identified from seven traders. In Taita Taveta the software was able to calculate a Food Habits nutritious diet that met all the requirements of the family, showing that food diversity in this place was sufficient to satisfy the nutrient needs while in Kitui; it fell short in calculating this diet for two age groups, Child (either sex) 6-8 months and Child (either sex) 9-11 months, showing that there is less variety of foods in this area. As much as breast milk significantly contributes to the energy, protein, fat, vitamin A and other micronutrient needs of this age group, there is still concern that their nutritional requirements will not be adequately met with this diet. The output of the CoD software shows that energy and iron are the limiting nutrients for these age groups.

Nutritional needs of children

The findings on the importance of milk in these two semi-arid counties aligns with the findings of previous research on the subject. According to Muinde (2011)about 51.1% of the children aged between 0 to 5 monthsin Taita Taveta County experienced adequate nutrition through exclusive breastfeeding. Based on these findings the researchers suggested the promotion of exclusive breastfeeding in the county for children under six-month-old, findings which are similar in part to those of Beyero (2018) and Deptford et al. (2017). Moreover, in regard to the introduction of solid, semisolid and soft foods Muinde (2011)determined that there was limited dietary diversity thus inducing nutritional deficiency. This is despite regular feeding frequency using solid and soft foods. The findings of this study align with those of Muinde (2011)likely suggesting that the food insecurity situation still persists in Taita Taveta County with significant health ramifications for this age group.The Kenya Demographic and Health Survey 2022 revealed that stunting is medium in Taita Taveta at 19% while in Kitui, it is high at 25% (Kenya National Bureau of Statistics, 2023). This is commensurate with the results stated above that the diet fails to satisfy some nutrients essential for the proper development of a child.The findings on the constitution and associated costs of LACON diets have thus practical evidence-based applications not only for the residents of Taita Taveta butalso Kitui County because the face similar circumstances on childhood nutrition.Although Beyero (2018) conducted a similar but in-depth research over a wider area in Pakistan, there

is a striking similarity in the findings as this study including the need to promote breast feeding for children under 2 years of age and increased nutritious dietary diversity through the promotion of LACON diets.

Adequacy of nutrients and cost of diets

The number of food items identified on the market was 111 in Taita Taveta and 79 in Kitui. However, because of high food prices, most of these foods do not constitute households' diets. For example, avocado was the only fruit forming part of the diet. Other fruit products identified were fruit juices, and only sugarcane juice appears in the diet in Taita Taveta County. It is worth noting that the WHO recommends a daily fruit intake of 200g/capita. It is also worth noting that fruit intake is a challenge not only in Kitui and Taita Taveta but across Kenya (Pengpid & Peltzer, 2018). For example, even in Western Kenya, where climatic conditions favour fruit production, fruit intake remains low while most of the fruits are sold to get income which is used to purchase staples (Waswa et al., 2014)

There is a challenge in meeting vitamin B12 and calcium, iron-which are derived largely from animal sources-using locally available foods, because of the high cost of purchasing these types of foods. Two micronutrients are especially important for children, pregnant women and non-pregnant, non-lactating at the peak of their reproductive years: iron and zinc (Conrad, Raatz & Jahns, 2018).Nevertheless, iron is a major missing nutrient in diets across Africa. While iron can be found in many food items, the rates at which it is absorbed from the foods are usually low. Hence, lower contributions than what the body needs. Because of low incomes, in developing countries like Kenya, diets are predominantly plant-based and consist of cereals, legumes, roots and tubers, vegetables and some fruits. The bioavailability of iron in these food items is thought to be less than 10% compared to the 15-35% found in meat. In the current study, the main source of iron and zinc in both Counties is plant-based: finger millet which has low absorption levels brought about by fibre inhibitors (Kumar et al., 2017). On the other hand, in Taita Taveta, the main source of iron and zinc is animal-based: pork.

The modelled LACON diet in Taita Taveta County included Grains and grain-based products; Meat and offal; Vegetables and vegetable products; Fruit and fruit products; Oil and fats and Herbs, spices, condiments, Fish, seafoods, amphibians and invertebrates; and Sugars and confectionary. These findings support the findings and recommendation of a previous baseline survey conducted in Taita Taveta County by Ngetich et al. (2013).The baseline survey concluded that while starches and cereals accounted for the bulk of the food

items consumed in this county, it was apparent that protein sources such as meats, pulses, legumes, nuts and seeds was profoundly lacking in the diet of most households in the study area. This current study thus builds on Ngetich et al. (2013)by providing a detailed and practical roadmap that can be used by policymakers and residents of Taita Taveta County to develop meaningful dietary diversity interventions that are cost effective hence promoting better health outcomes.

Acceptability of Diet

In Taita Taveta, avocado takes 5.1% of the weight of the diet; this amount is not practical for a family to consume over the year since it considered a fruit and not a main food. Similarly, while millet is a cheap source of nutrients in both Taita Taveta and Kitui, contributing up to 8.7% and 21.6% to the diet respectively; the main food consumed in most households in Kenya is maize flour (Icheria et al., 2021). There is thus a need to promote the production of millet in the region (Taita Taveta and Kitui Counties) as well as the county in the region. This is because the high demand of maize, which is a staple on most areas of the country often outpaces the supply, especially during the lean season with its availability being limited because of higher prices. One strategy that can be embraced is the progressive incentivization of the consumption of millet by both governmental and non-governmental agencies. This strategy that can help foster an attitude change within communities to change their feeding habits towards cheaper and more sustainable food options that can be made available during the plenty and lean seasons.

Refined wheat flour is a cheap source of several nutrients as a by-product of fortification with Iron and zinc, which was a cost-effective strategy recommended by WHO and mandated by the Ministry of Public Health and Sanitation through a Legal Notice no. 62 of 15th June 2012 to combat micronutrient deficiencies. While this nutrient source features as part of the locally adapted cost optimised nutritious diet for both counties, this study failed to examine the source of this source. The fact that refined wheat flour is part of the official government strategy meant that it was more likely than not that the supply of this food item was influenced by government food interventions in a bit to combat food insecurity, especially during the particularly lean seasons occasioned by drought. The failure of this study to inculcate the existing social protection schemes that manipulate the supply of nutrient rich food items undermines the sustainability of the recommendations herein, particularly if the food items provided by such programs becomes a part of the LACON diet. This is because

fluctuation in funding as well as regime changes can significantly influence the level of support these social protection program receive with potential deleterious impact for the residents of Kitui and Taita Taveta Counties.

Study Limitations

a) While the costs of LACON diets were modelled, it was not possible to determine the affordability of the diets to households because Household Economy Approach (HEA) studies were not conducted. HEA studies would have been used to gauge households' economic status and their ability to afford nutritious habits.

b) Due to time and budgetary constraints, only two FGDs were conducted in each county, one FGD per village. By contrast, in Kitui, 14 traders drawn from seven market centres were surveyed for the market survey. In Taita Taveta County, 18 traders drawn from 7 market centres were surveyed. It is possible that the data collected via the FGDs (on dietary habits) might not have been adequately representative of each county. Had time and money allowed, an FGD would have been conducted at or in the vicinity of every market centre surveyed.

c) Only the foods available on the market were analysed and used for modelling. Wild foods and foods produced and consumed by households but not available for sale were not taken into consideration.

d) The nutrients used for modelling were based on raw foods, yet nutrient losses during food preparation would be expected.

e) In calculating the costs of the diets, the software has included some foods in quantities that are not realistic. Therefore, it is not possible to ascertain the impact that a more realistic diet will have on the cost.

f) The number of household members was determined arbitrarily meaning that the real composition of families in the area may be different since family units are unique in terms of ages and individuals represented in a home.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The reality of an inadequate variety of foods that can supply sufficient nutrients for non-pregnant, non-lactating reproductive-age women in Kitui County and Taita Taveta counties can be tackled using locally adapted nutritious diets based on the availability and nutritional value of the locally available food. In Taita Taveta county the locally adapted cost optimised nutritious diets includes Avocados, small, dried fish, Amaranth leaf (as the main vegetable), refined wheat flour and millet grain which is estimated to cost $3.46 daily.

In Kitui County,the locally adapted cost optimised nutritious diets eggs, vegetable fat, spinach (as the main vegetable), wheat flour and millet grain which is estimated to cost $4.36 daily. These locally adapted diets are designed to provide key nutrients such as protein, carbohydrates, Vitamins such as A,B1, B2, C, and B12 and crucial minerals such as iron, calcium and zinc.

6.2 Recommendations

a) The limited fruit intake in the study areas presents a need to explore and implement interventions aimed at increasing fruit intake. One such intervention could be processing and preserving locally available fruits to ensure their availability throughout the year. Moreover, vegetables can be dried during the plenty season and preserved for use during the lean season to guarantee constant supply with the change of weather.

b) Given the importance of iron in the study population and the role of meat in supplying adequate quantities, pig farming should be promoted in Kitui as in Taita Taveta. Also, compared to other types of meat like beef, pork tends to be cheaper. Nevertheless, an alternative cheaper source, next to pork, will need to be considered because of religious beliefs, i.e., Muslims do not eat pork and will be averse to promoting it as part of the diet.

c) Participatory Community based farm diversification and nutrition education to increase farm, market, and dietary diversity. This approach enables the community to evaluate their own food and nutrition situation and identify the causes of problems according to their experiences. Eventually, solutions will originate from them thus enabling them to embrace needful changes.

d) Micronutrient supplementation and fortification, e.g., iron-folic acid (IFA) supplementation and home fortification with micronutrient powders (MNP)

e) Comprehensive nutrition education such as Infant and Young Child Feeding (IYCF) activities to empower the woman on balanced diets because they are the primary caregivers.

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Appendix 1: Market Survey Data Sheet

MARKET SURVEY DATA SHEET

This survey is being conducted by the University of Nairobi, Kenya to determine how daily diet cost in Kitui/Taita Taveta County can be reduced. This questionnaire, therefore, is to assess the various food items and their corresponding prices and weights on the market in the County. Confidentiality of the information you provide is assured.

Foods are to be measured at least three different weights if only there are different weights at which foods are sold. If the unit of measurement is different from the stated (g), write the right unit for that food.

Date		**Village/Place of trade**		**Trader ID**		**Interviewer:**		
Local Name	**English Name**	**Price (KES) Plenty season**	**WEIGHT**			**Source** **1. Own production** **2. Farm gate** **3. Wholesalers** **4. Retailers** **5. Others-specify**	**If wholesalers/retailers** **1. From Village** **2. From Taita County** **3. Within Kenya** **4. Outside Kenya**	**Specify location if wholesalers / retailers**
			1	**2**	**3**			
Grains and grain-based products								
Mahindi	Maize, dried, raw		g	g	g			
Ungawamahindi	Maize, flour, dry		g	g	g			
Wimbi	Millet, finger		g	g	g			
Mchele	Rice, raw		g	g	g			
Mtama	Sorghum		g	g	g			

	Spaghetti, dry, unenriched		g	g	g			
Ungawangano	Wheat, flour		g	g	g			
Ngano	Wheat, grain, all-purpose 72% extract		g	g	g			
Ungawamahindi	Maize, white, flour, refined		g	g	g			
Mandazi	African donut		g	g	g			
roots and tubers								
Waru	Potato,english, raw		g	g	g			
legumes, nuts, and seeds								
Maharagwe	Bean, kidney, dried, raw		g	g	g			
	Macadamia							
meat and offal								
Nyama yambuzi	Goat, meat, raw		g	g	g			
Nyama yang'ombe	Cow, meat, raw		g	g	g			
Nyama ya kuku	Chicken, meat, raw		g	g	g			
fish, seafood, amphibians, and invertebrates								
Omena	Fish, small, dried, freshwater		g	g	g			
eggs and egg products								
Mayai ya kuku	Egg, chicken		g	g	g			
milk and milk products								
Maziwayapoda	Milk, cow, powdered, whole		g	g	g			

Maziwayang'ombe	Milk, cow, whole		g	g	g			
vegetables and vegetable products								
Kabichi	Cabbage, green or white, raw		g	g	g			
Mrenda	Leaf, jute mallow, raw		g	g	g			
Kitungumatawi	Leaf, onion		g	g	g			
Kitunguviazi	Onion tuber		g	g	g			
Malungu	Pumpkin leaves		g	g	g			
Nyanya	Tomato		g	g	g			
Sukuma wiki	Kales, raw		g	g	g			
	spinach		g	g	g			
Terere	Amaranthus, raw		g	g	g			
Ndunda	Nightshade		g	g	g			
Mkunde	Cowpea leaves, raw		g	g	g			
Mchunga	Bitter Lettuce		g	g	g			
fruit and fruit products								
Ndizi	Banana, ripe, large		g	g	g			
Machungwa	Oranges		g	g	g			
Mapera	Guava		g	g	g			
Parachichi	Avocado		g	g	g			
Ongolua	Passion		g	g	g			
	Tree tomato		g	g	g			
oil and fats								
Mafuta	Fat, vegetable,		g	g	g			

	hydrogenated							
Salad	Oil		g	g	g			
sugars and confectionary								
Sukari	Sugar		g	g	g			
herbs, spices, and condiments								
Baking	Baking powder		g	g	g			
Chumvi	Salt, iodized		g	g	g			
other new foods								
			g	g	g			
			g	g	g			
			g	g	g			
			g	g	g			
			g	g	g			
			g	g	g			
			g	g	g			
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			g	g	g			
			g	g	g			
			g	g	g			
			g	g	g			

Appendix 2: Dietary habits interview sheet

Date		Area	
Village		Season	Lean
Interviewee		Interviewer	

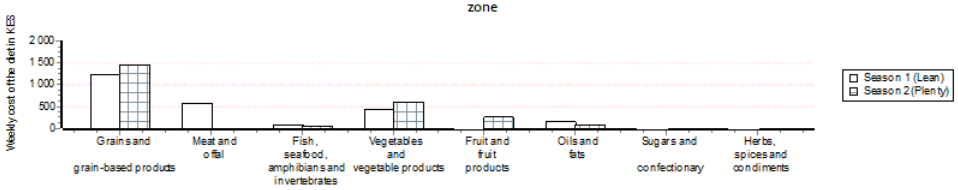
When available or in season how many times does your household typically eat X?

Food Name		Consumption Frequencies from Interviews			
Local Name	English Name	Usually (5 days + per week)	Often (1-4 days per week)	Rarely (Once a year, once a month, etc.)	Never
Grains and grain-based products					
Mahindi	Maize, dried, raw				
Muthokoi	Maize without seed coat				
Ugali	Maize, flour, dry				
Uji	Millet, finger				
Mchele	Rice, raw				
Spaghetti	Spaghetti, dry, unenriched				
Chapati	Wheat, flour				
Mandazi	African donut				
Keki	Cake				
Roots and tubers					
Viazi	Potato, English, raw				
Legumes, nuts, and seeds					
Maharagwe	Bean, kidney, dried, raw				
Nzoko	Cowpeas, dried				
Ndengu	Greengrams				
Nzuu	Pigeon peas				
Meat and offal					
Nyama yambuzi	Goat, meat, raw				
Nyama yang'ombe	Cow, meat, raw				
Nyama ya kuku	Chicken, meat, raw				
Fish, seafood, amphibians, and invertebrates					
Omena	Fish, small, dried, freshwater				
Eggs and egg products					
Mayai ya kuku	Egg, chicken				

Milk and milk products					
Maziwayang'ombe	Milk, cow, whole				
Vegetables and vegetable products					
Kunde	Cowpea leaves, raw				
Kabichi	Cabbage, green or white, raw				
Kitunguu	Onion tuber				
MatawiyaMalenge	Pumpkin leaves				
Nyanya	Tomato				
Sukuma wiki	Kales, raw				
Spinach	Spinach				
Terere	Amaranthus, raw				
Managu	Nightshade				
Carrot	Carrot				
Fruit and fruit products					
Ndizi	Banana, ripe				
Machungwa	Oranges				
Mapera	Guava				
Avocado	Avocado				
Passion	Passion				
Maembe	Mango				
Paipai	Pawpaw				
Ndimu	Lemon				
Oil and fats					
Mafuta	Fat, vegetable, hydrogenated				
Salad	Oil				
Sugars and confectionary					
Sukari	Sugar				
Herbs, spices, and condiments					
Chumvi	Salt, iodized				
Royco					
Other new foods					

Appendix 3: The average weekly cost of foods selected by season by cost of the diet software for a food habits nutritious diet in Taita

The average weekly cost of foods selected by season by the cost of the diet software for a food habits nutritious diet for the family in the Rural Zone livelihood zone

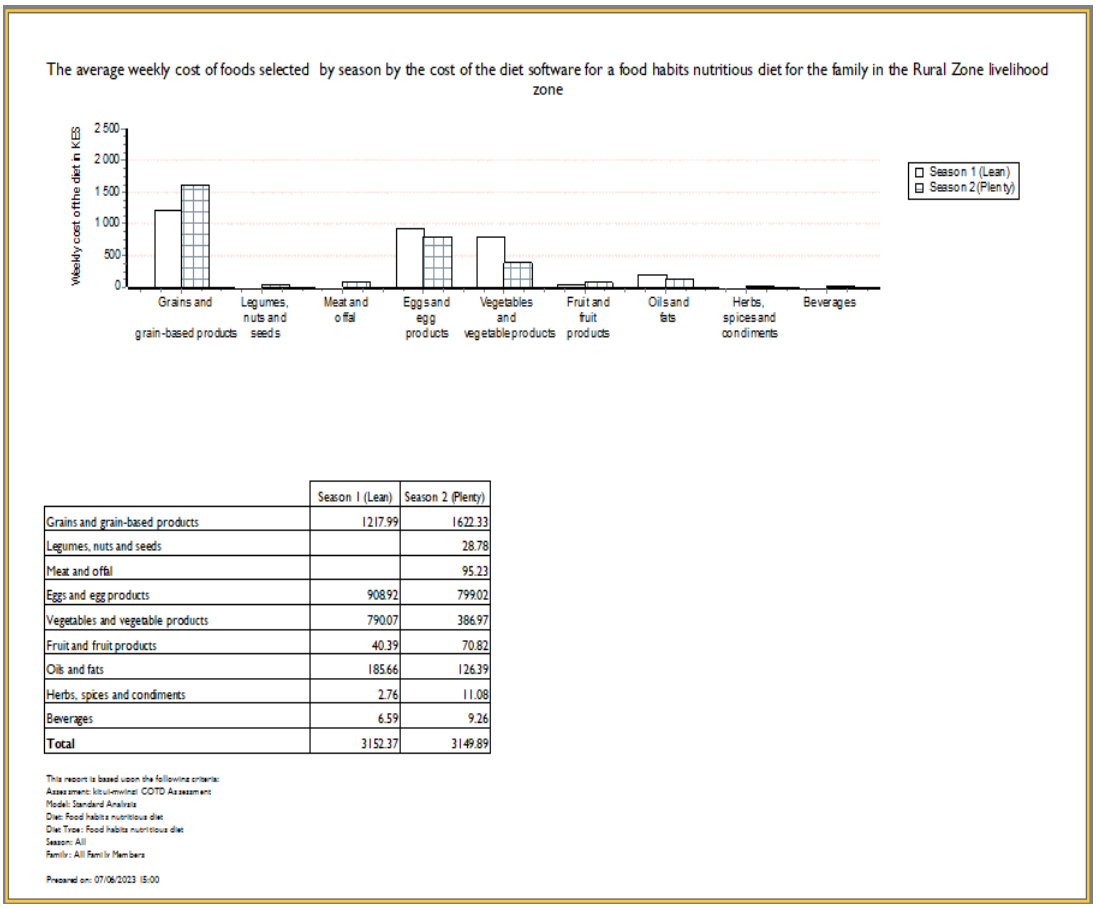


	Season 1 (Lean)	Season 2 (Plenty)
Grains and grain-based products	1245.12	1450.86
Meat and offal	575.13	
Fish, seafood, amphibians and invertebrates	78.21	75.03
Vegetables and vegetable products	442.20	612.93
Fruit and fruit products		257.92
Oils and fats	161.72	85.15
Sugars and confectionary		6.45
Herbs, spices and condiments	2.74	2.47
Total	2505.12	2490.81

This report is based upon the following criteria:
Assessment: Taita-Wundanyi COTD Assessment
Model: Standard Analysis
Diet: Food habits nutritious diet
Diet Type: Food habits nutritious diet
Season: All
Family: All Family Members

Prepared on: 07/06/2023 15:04

Appendix 4: The average weekly cost of foods selected by season by cost of the diet software for a food habits nutritious diet in Kitui



	Season 1 (Lean)	Season 2 (Plenty)
Grains and grain-based products	1217.99	1622.33
Legumes, nuts and seeds		28.78
Meat and offal		95.23
Eggs and egg products	908.92	799.02
Vegetables and vegetable products	790.07	386.97
Fruit and fruit products	40.39	70.82
Oils and fats	185.66	126.39
Herbs, spices and condiments	2.76	11.08
Beverages	6.59	9.26
Total	3152.37	3149.89

This report is based upon the following criteria:
Assessment: kitui-mwinzi COTD Assessment
Model: Standard Analysis
Diet: Food habits nutritious diet
Diet Tree: Food habits nutritious diet
Season: All
Family: All Family Members

Prepared on: 07/06/2023 15:00

Appendix 5: Dietary Habits Interview Analysis Summary

DIETARY HABITS INTERVIEW ANALYSIS SUMMARY												
FOOD NAME		**Percentage of interview respondents**				**Analysis of interview results for food habits diet**					
Local Name	**English Name**	**Usually**	**Often**	**Rarely**	**Never**	**Score Usually**	**Score Often**	**Score Rarely**	**Total Score**	**Min**	**Max**
		(5 days + per week)	**(1-4 days per week)**	**(Once a year, once a month etc.)**		**(2 points)**	**(1 point)**	**(0.5 point)**			
Grains and grain-based products											

	Bread, soda	17.14	58.57	24.29	0.00	2.74	4.69	0.97	8.40	0	7
	Maize, dried, raw	43.57	56.43	0.00	0.00	6.97	4.51	0.00	11.49	0	14
	Maize, flour, dry	53.57	46.43	0.00	0.00	8.57	3.71	0.00	12.29	0	14
	Maize, green, raw	43.57	56.43	0.00	0.00	6.97	4.51	0.00	11.49	0	14
	Maize, meal, degermed, unenriched, white (Kenya)	53.57	46.43	0.00	0.00	8.57	3.71	0.00	12.29	0	14
	Maize, white, flour, refined (Kenya)	53.57	46.43	0.00	0.00	8.57	3.71	0.00	12.29	0	14
	Millet, bulrush	5.00	55.00	35.00	5.00	0.80	4.40	1.40	6.60	0	7
	Millet, finger, flour (Kenya)	5.00	55.00	35.00	5.00	0.80	4.40	1.40	6.60	0	7
	Millet, finger, grain, dried, raw (Kenya)	5.00	55.00	35.00	5.00	0.80	4.40	1.40	6.60	0	7
	Noodle, dried (Kenya)	0.00	24.29	58.57	17.14	0.00	1.94	2.34	4.29	0	7
	Rice, raw	7.14	82.86	10.00	0.00	1.14	6.63	0.40	8.17	0	7
	Sorghum, grain, red, dried, raw (Kenya)	5.00	55.00	35.00	5.00	0.80	4.40	1.40	6.60	0	7
	Spaghetti, dry, unenriched (Kenya)	0.00	24.29	58.57	17.14	0.00	1.94	2.34	4.29	0	7
	Wheat, flour, all purpose, 72% extract	17.14	65.71	17.14	0.00	2.74	5.26	0.69	8.69	0	7
	Wheat, flour, refined (Kenya)	17.14	65.71	17.14	0.00	2.74	5.26	0.69	8.69	0	7
	Wheat, grain or flour, CotD (Kenya)	17.14	65.71	17.14	0.00	2.74	5.26	0.69	8.69	0	7

FOOD NAME		**Percentage of interview respondents**				**Analysis of interview results for food habits diet**					
Local Name	**English Name**	**Usually**	**Often**	**Rarely**	**Never**	**Score Usually**	**Score Often**	**Score Rarely**	**Total Score**	**Min**	**Max**
		(5 days + per week)	**(1-4 days per week)**	**(Once a year, once a month etc.)**		**(2 points)**	**(1 point)**	**(0.5 point)**			

Roots and tubers											
	Arrowroot, raw (Kenya)	5.00	36.43	32.14	26.43	0.80	2.91	1.29	5.00	0	7
	Beet root, red, raw (Kenya)	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Cassava, raw	5.00	36.43	32.14	26.43	0.80	2.91	1.29	5.00	0	7
	Potato, english, raw	12.14	29.29	53.57	5.00	1.94	2.34	2.14	6.43	0	7
	Sweet potato, raw	5.00	36.43	32.14	26.43	0.80	2.91	1.29	5.00	0	7
Legumes, nuts and seeds											
	Bean, kidney, dried, raw	24.29	58.57	17.14	0.00	3.89	4.69	0.69	9.26	0	14
	Cowpea, dried, raw (Kenya)	24.29	58.57	17.14	0.00	3.89	4.69	0.69	9.26	0	14
	Green gram, whole, dried, raw (Kenya)	24.29	58.57	17.14	0.00	3.89	4.69	0.69	9.26	0	14
	Peanut, roasted, shelled (Kenya)	5.00	31.43	53.57	10.00	0.80	2.51	2.14	5.46	0	7
	Pigeon pea, raw	14.29	28.57	57.14	0.00	2.29	2.29	2.29	6.86	0	7
Meat and offal											
	Beef, medium fat, raw	0.00	22.14	72.86	5.00	0.00	1.77	2.91	4.69	0	7
	Chicken, raw	0.00	20.00	75.00	5.00	0.00	1.60	3.00	4.60	0	7
	Goat, raw	5.00	27.14	55.71	12.14	0.80	2.17	2.23	5.20	0	7
	Lamb/Mutton, meat, moderately fat, raw (Kenya)	5.00	27.14	55.71	12.14	0.80	2.17	2.23	5.20	0	7
	Pork, meat, raw (Kenya)	5.00	27.14	55.71	12.14	0.80	2.17	2.23	5.20	0	7
Fish, seafood, amphibians and invertebrates											
	Fish, small, dried, fresh water (Kenya)	20.00	57.86	22.14	0.00	3.20	4.63	0.89	8.71	0	7
Eggs and egg products											
	Egg, whole, raw (Kenya)	12.14	22.14	60.71	5.00	1.94	1.77	2.43	6.14	0	7

FOOD NAME	**Percentage of interview respondents**	**Analysis of interview results for food habits diet**

Local Name	English Name	Usually (5 days + per week)	Often (1-4 days per week)	Rarely (Once a year, once a month etc.)	Never	Score Usually (2 points)	Score Often (1 point)	Score Rarely (0.5 point)	Total Score	Min	Max
Milk and milk products											
	Milk, cow, fresh, non fortified	53.57	34.29	5.00	7.14	8.57	2.74	0.20	11.51	0	14
	Milk, cow, UHT	53.57	34.29	5.00	7.14	8.57	2.74	0.20	11.51	0	14
	Milk, cow, whole, fermented (Industrial)	53.57	34.29	5.00	7.14	8.57	2.74	0.20	11.51	0	14
	Yoghurt, whole milk, plain (Kenya)	53.57	34.29	5.00	7.14	8.57	2.74	0.20	11.51	0	14

FOOD NAME		Percentage of interview respondents				Analysis of interview results for food habits diet					
Local Name	**English Name**	**Usually (5 days + per week)**	**Often (1-4 days per week)**	**Rarely (Once a year, once a month etc.)**	**Never**	**Score Usually (2 points)**	**Score Often (1 point)**	**Score Rarely (0.5 point)**	**Total Score**	**Min**	**Max**
Vegetables and vegetable products											
	Bean, french, mature, raw	27.14	34.29	38.57	0.00	4.34	2.74	1.54	8.63	0	7
	Cabbage, green or white, raw	27.14	34.29	38.57	0.00	4.34	2.74	1.54	8.63	0	7
	Carrot, raw (Kenya)	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Cucumber, raw (Kenya)	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Drumstick pods, raw	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Eggplant, raw (kenya)	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Kale, raw (Kenya)	54.29	21.43	24.29	0.00	8.69	1.71	0.97	11.37	0	14
	Leaf, amaranth, raw (Kenya)	22.14	31.43	41.43	5.00	3.54	2.51	1.66	7.71	0	7

	Leaf, amaranth, raw-black night shade (Kenya)	5.00	63.57	31.43	0.00	0.80	5.09	1.26	7.14	0	7
	Leaf, amaranth, spider plant & nightshade (Kenya)	22.14	31.43	41.43	5.00	3.54	2.51	1.66	7.71	0	7
	Leaf, cowpea, raw (Kenya)	26.43	26.43	37.14	10.00	4.23	2.11	1.49	7.83	0	7
	Leaf, onion	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Leaf, pumpkin	27.14	50.71	22.14	0.00	4.34	4.06	0.89	9.29	0	14
	Leeks, raw (Kenya)	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Lettuce, green leaf, raw	0.00	48.57	51.43	0.00	0.00	3.89	2.06	5.94	0	7
	Okra, raw (Kenya)	0.00	0.00	60.00	40.00	0.00	0.00	2.40	2.40	0	7
	Onion tuber	82.86	12.14	5.00	0.00	13.26	0.97	0.20	14.43	0	14
	Peppers, sweet, green, raw (Kenya)	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Pumpkin, raw or cooked	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Spinach, raw (Kenya)	15.00	48.57	36.43	0.00	2.40	3.89	1.46	7.74	0	7

FOOD NAME		**Percentage of interview respondents**				**Analysis of interview results for food habits diet**					
Local Name	**English Name**	**Usually**	**Often**	**Rarely**	**Never**	**Score Usually**	**Score Often**	**Score Rarely**	**Total Score**	**Min**	**Max**
		(5 days + per week)	**(1-4 days per week)**	**(Once a year, once a month etc.)**		**(2 points)**	**(1 point)**	**(0.5 point)**			
Fruit and fruit products											
	Avocado (Kenya)	60.71	22.14	17.14	0.00	9.71	1.77	0.69	12.17	0	14
	Banana, large, ripe	20.00	62.86	17.14	0.00	3.20	5.03	0.69	8.91	0	7
	Banana, large, unripe	12.14	29.29	53.57	5.00	1.94	2.34	2.14	6.43	0	7
	Coconut, fresh, mature	10.00	19.29	70.71	0.00	1.60	1.54	2.83	5.97	0	7

	fruit, flesh (Kenya)										
	Custard apple (Kenya)	5.00	5.00	43.57	46.43	0.80	0.40	1.74	2.94	0	7
	Grapefruit (Kenya)	10.00	0.00	39.29	50.71	1.60	0.00	1.57	3.17	0	7
	Guava (Kenya)	41.43	34.29	24.29	0.00	6.63	2.74	0.97	10.34	0	14
	Horned melon, kiwano	10.00	0.00	39.29	50.71	1.60	0.00	1.57	3.17	0	7
	Mango, juice (Kenya)	5.00	29.29	55.71	10.00	0.80	2.34	2.23	5.37	0	7
	Mango, ripe, raw (Kenya)	10.00	19.29	70.71	0.00	1.60	1.54	2.83	5.97	0	7
	Orange (Kenya)	15.00	29.29	50.71	5.00	2.40	2.34	2.03	6.77	0	7
	Orange, juice	12.14	27.14	55.71	5.00	1.94	2.17	2.23	6.34	0	7
	Papaya, ripe or unripe	5.00	19.29	65.71	10.00	0.80	1.54	2.63	4.97	0	7
	Passion fruit	22.14	24.29	46.43	7.14	3.54	1.94	1.86	7.34	0	7
	Pineapple (Kenya)	5.00	29.29	55.71	10.00	0.80	2.34	2.23	5.37	0	7
	Pineapple, juice	12.14	29.29	41.43	17.14	1.94	2.34	1.66	5.94	0	7
	Tamarind, fresh, raw (Kenya)	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0	0
	Tomato, red, ripe, raw (Kenya)	56.43	33.57	10.00	0.00	9.03	2.69	0.40	12.11	0	14
	Tree tomato, dark red skin, peeled, raw	15.00	5.00	17.14	62.86	2.40	0.40	0.69	3.49	0	7
	Watermelon (Kenya)	10.00	19.29	70.71	0.00	1.60	1.54	2.83	5.97	0	7

FOOD NAME		**Percentage of interview respondents**				**Analysis of interview results for food habits diet**					
Local Name	**English Name**	**Usually**	**Often**	**Rarely**	**Never**	**Score Usually**	**Score Often**	**Score Rarely**	**Total Score**	**Min**	**Max**
		(5 days + per week)	**(1-4 days per week)**	**(Once a year, once a month etc.)**		**(2 points)**	**(1 point)**	**(0.5 point)**			
Oils and fats											
	Fat, vegetable,	51.43	0.00	12.14	36.43	8.23	0.00	0.49	8.71	0	7

	cowboy, kapra or kimbo										
	Margarine	21.43	10.00	37.14	31.43	3.43	0.80	1.49	5.71	0	7
	Oil, corn	77.86	5.00	12.14	5.00	12.46	0.40	0.49	13.34	0	14
Sugars and confectionary											
	Biscuit, sweet (Kenya)	0.00	10.00	80.00	10.00	0.00	0.80	3.20	4.00	0	7
	Cake (Kenya)	0.00	10.00	80.00	10.00	0.00	0.80	3.20	4.00	0	7
	Candy, hard	12.14	25.00	33.57	29.29	1.94	2.00	1.34	5.29	0	7
	Honey (Kenya)	0.00	10.00	80.00	10.00	0.00	0.80	3.20	4.00	0	7
	Sugar (Kenya)	85.71	14.29	0.00	0.00	13.71	1.14	0.00	14.86	0	14
	Sugarcane, juice (Kenya)	0.00	10.00	80.00	10.00	0.00	0.80	3.20	4.00	0	7
	Wheat, dough, deep fried	17.14	58.57	24.29	0.00	2.74	4.69	0.97	8.40	0	7

FOOD NAME		**Percentage of interview respondents**				**Analysis of interview results for food habits diet**					
Local Name	**English Name**	**Usually**	**Often**	**Rarely**	**Never**	**Score Usually**	**Score Often**	**Score Rarely**	**Total Score**	**Min**	**Max**
		(5 days + per week)	**(1-4 days per week)**	**(Once a year, once a month etc.)**		**(2 points)**	**(1 point)**	**(0.5 point)**			
Herbs, spices and condiments											
	Baking powder	5.00	19.29	41.43	34.29	0.80	1.54	1.66	4.00	0	7
	Bouillon mix, roiko	37.14	12.14	24.29	26.43	5.94	0.97	0.97	7.89	0	7
	Coriander, leaf, raw (Kenya)	17.14	42.14	19.29	21.43	2.74	3.37	0.77	6.89	0	7
	Curry powder	37.14	12.14	24.29	26.43	5.94	0.97	0.97	7.89	0	7
	Dextrose, fortified, glucolin	5.00	12.14	36.43	46.43	0.80	0.97	1.46	3.23	0	7
	Garlic, raw (Kenya)	7.14	17.14	49.29	26.43	1.14	1.37	1.97	4.49	0	7
	Ginger root, raw (Kenya)	7.14	17.14	49.29	26.43	1.14	1.37	1.97	4.49	0	7
	Lemon, juice	0.00	12.14	58.57	29.29	0.00	0.97	2.34	3.31	0	7
	Lemon, raw, without peel (Kenya)	10.00	5.00	75.00	10.00	1.60	0.40	3.00	5.00	0	7

	Pepper, red or cayenne (kenya)	10.00	5.00	75.00	10.00	1.60	0.40	3.00	5.00	0	7
	Salt, iodized	100.00	0.00	0.00	0.00	16.00	0.00	0.00	16.00	7	14
	Sauce, hot chilli	0.00	10.00	85.00	5.00	0.00	0.80	3.40	4.20	0	7
	Tomato sauce (Kenya)	10.00	5.00	75.00	10.00	1.60	0.40	3.00	5.00	0	7
	Tomato, paste (Kenya)	10.00	5.00	75.00	10.00	1.60	0.40	3.00	5.00	0	7
	Yeast, dried (Kenya)	5.00	12.14	36.43	46.43	0.80	0.97	1.46	3.23	0	7

FOOD NAME		**Percentage of interview respondents**				**Analysis of interview results for food habits diet**					
Local Name	**English Name**	**Usually**	**Often**	**Rarely**	**Never**	**Score Usually**	**Score Often**	**Score Rarely**	**Total Score**	**Min**	**Max**
		(5 days + per week)	**(1-4 days per week)**	**(Once a year, once a month etc.)**		**(2 points)**	**(1 point)**	**(0.5 point)**			
Beverages											
	Beverage, blackcurrant syrup, ribena	5.00	10.00	41.43	43.57	0.80	0.80	1.66	3.26	0	7
	Beverage, carbonated, non-alcoholic	5.00	10.00	41.43	43.57	0.80	0.80	1.66	3.26	0	7
	Beverage, carbonated, non-alcoholic, pepsi	5.00	10.00	41.43	43.57	0.80	0.80	1.66	3.26	0	7
	Chocolate mix, powdered, milo (Kenya)	53.57	34.29	5.00	7.14	8.57	2.74	0.20	11.51	0	14
	Coffee, ground, dry	53.57	34.29	5.00	7.14	8.57	2.74	0.20	11.51	0	14
	Coffee, instant (Kenya)	53.57	34.29	5.00	7.14	8.57	2.74	0.20	11.51	0	14
	Tea, leaf, dry	53.57	34.29	5.00	7.14	8.57	2.74	0.20	11.51	0	14
Supplements and infant foods											
	Weetabix	0.00	10.00	80.00	10.00	0.00	0.80	3.20	4.00	0	7